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# ENGINEERING & MINING JOURNAL-PRESS

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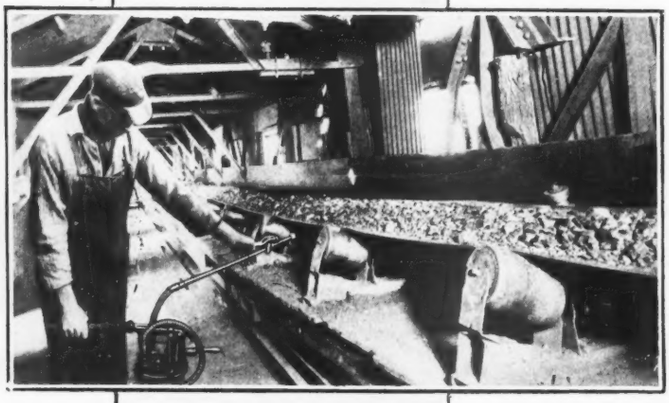

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

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## The Future of Mining

REGARDING the mining industries during 1924, the outlook is that they will be more prosperous than in 1923. We stated the reasons for this belief in an editorial in the Annual Review Number and Year Book, in January. This followed the special editorial which Mr. Herbert Hoover contributed especially for this issue, in which he made the same prognostication based upon somewhat wider and different ground.

The outlook for the mining industries in general, however, taking it year in and year out, is founded upon something much more basic—namely, that the mining industries produce the sinews and raw materials for all industries and enterprises, and constitute the very bedrock of civilization itself. No matter what industries rise or fall, the average demand for the products of the mining industries continues increasing and is bound to continue to do so with increase in population and the development of any and all industries. Nothing except a decline in civilization could effect a permanent decline in the mining industries. For the products of the mining industries, there are no substitutes.

This means that we can say confidently that five years from now there will be far more metals mined than today and that ten years from now there will be more metals mined than five years from now.

The above being the case, which is recognized as an axiom by students of political economy of mining, the main question which has been and which is being raised is where the supplies for the future increased demand will come from. The answer is, of course, that they will be obtained by mining lower and lower grade material. This means that much more rock, on the average, will have to be moved five or ten years from now to get a ton of lead or zinc than at present. This means that an increased amount of machinery per ton of metal will have to be used progressively in the future. Manual labor will have to be reduced more and more, and this evolution is actually going on very rapidly.

The figures of the total production of the United States for the last forty years show that the total value of mining products in the United States has risen from about one-half billion dollars to four and one-half to five billion dollars, or more than ten times. The war has produced irregularity in the curve, due to overproduction in the latter part of the war and the consequent paralysis in the year or two following. Nothing except another great war or a similar industrial or political upheaval will effect the steady rise of consumption or production again. If we should chart the consumption for these years, it would not show the same irregularity.

Nevertheless, the facts which we have cited prove that with the progressive inevitable increase in production, is going on and will go on a progressive evolution in the mining industries, as to methods, organization, and centers of production. Useless to look backward and to try to stop or erase what the "moving finger writes," since all your efforts shall not "wash out one word of it." "The wise man is he that looks forward, foresees the inevitable trend of developments, and adjusts his plans accordingly."

Mining in the future will be on lower grade ores with still larger operating and financial organizations, and will be more and more world-wide as the combing process for economically possible mining operations progresses.

## Ventilating the Copper Tariff Question

THE HOPE of those who advocate a copper tariff is that it will raise the price of the metal. Examples are cited in other commodities where this result has occurred, but generally the situation in those commodities is dissimilar and a comparison permits unsafe deductions to be drawn. It does not necessarily follow that a tariff of 5c. per lb. on copper will raise the domestic price—at least, not under present producing conditions, with an exportable surplus eager for a market. In our discussion columns this week is a letter from Mr. Gordon Campbell, president of the Calumet & Arizona Mining Co., advocating a tariff on copper, and a letter from Mr. George L. Walker opposed to one. Mr. Campbell in unfolding his argument infers that the market for copper, lead, and zinc can be controlled by the producers with the help of a tariff. This is not our understanding. The price of copper, lead, and zinc is fixed in the world market by the free play of economic forces and varies from day to day and from center to center, depending upon local and foreign conditions. This is true of those metals that are heavily protected, such as lead, as well as those that have no protection, such as copper. The New York and London lead markets move parallel with each other, but are separated by the tariff differential, or close to it, as we have pointed out before. On Feb. 28, for example, the price of spot pig lead in London was the equivalent of 7.20c. per lb., whereas that in New York was 9 to 9½c. per lb., leaving a difference of from 1.80 to 2.30c. per lb., which covers the tariff differential. But lead production in the United States has not been great enough to satisfy domestic consumption; hence the tariff has become well established. Surely that is not the situation in copper. Domestic copper producers nearly always have mined an output greater than domestic requirements, so that a surplus is available for export purposes. In fact, it must have this export outlet or it would demoralize the American market. Let us examine the situation in zinc. It happens to parallel that of copper rather closely just now. Zinc is protected by a tariff of 1¾c. per lb. There is also a surplus production of zinc at present. The surplus zinc production must have a market. If sold in this country it depresses domestic prices and it is only sold abroad if the foreign market is higher and profitable to sell in.

This is precisely what the surplus zinc is doing. It has depressed local prices until they have dropped to a level permitting exports of zinc to Europe.

We are also in disagreement with Mr. Campbell's belief that surplus metal should be sold abroad, even at a reduced price, while asking a higher domestic price under tariff protection. This is known as "dumping." It isn't being done in the metal markets, although one hears of it occasionally in the selling of manufactured articles abroad. Zinc producers, according to Mr. Campbell's reasoning, have a chance to do that now. But they are refraining because no one zinc company wants to be the "goat." Organized "dumping" requires governmental assistance to make it effective. In fact, this very practice is being contemplated now by Congress in behalf of the farmers under the McNary-Haugen bill. How we protest, however, when other governments resort to such practice!

Isn't there a tendency for this tariff agitation to becloud the real trouble in the copper situation? Would not more be gained, for one thing, by a concerted effort on the part of all American copper-mining companies to urge a settlement of the reparations mess, thereby opening up markets that are languishing?

## An Achievement in Electrical Prospecting

DISCOVERY IN SWEDEN of two new iron and copper sulphide ore fields, the deposits in which were totally masked or covered with glacial drift, has been accomplished since 1918 by prospecting with electrical apparatus devised by Hans Lundberg and Harry Nathorst. These are the Kristineberg and the Bjurfors fields, both in the Skelleftea district, about 450 miles north of Stockholm. The former was found late in 1918 and the latter in the summer of 1922. Since 1918 the method has been tried—successfully it is claimed—by a Swedish company at about sixty different districts in Sweden, Norway, Finland, and Spain. Efforts to improve the method have been made by the company, the Swedish Geological Survey, and others. An elementary description of the procedure followed and of the results obtained in the Kristineberg and Bjurfors fields has been written by Lundberg and published within the last year by the Survey in Sweden. A foreword by Axel Gavelin, director of the Survey and also a member of the Society of Economic Geologists, serves to introduce this interesting bulletin properly. Lundberg is now prospecting for zinc ore with his method for the Empire Zinc Co. at Hanover, N. M.

Development of the Schlumberger method of using electricity for prospecting for metallic ores has already been described at length in the *Mining Journal-Press*. Briefly it consists in observing the distribution of an alternating electric current passed through the ground, each of the two contacts with the earth being made with several metallic pegs connected with each other and driven in the ground several meters apart, usually in a circle. Potential differences established in the area between the two circular contacts are determined by means of a movable length of wire having a non-polarizing electrode at either end and a galvanometer in between. Points of equal potential may thus be located, and when mapped, the resulting configuration of equipotential lines indicates the presence of conducting masses beneath the surface. Similarly, the method described by Lundberg consists in studying the distribution of potential in an electrical field produced in the earth by applying a potential difference between two points on the ground. But it is to the use of so-called "extended" electrodes that the success obtained with the latter method is said to be due. "It is necessary," says Lundberg, "to provide a large favorable contact area between the ground and the electrodes. The electrodes are therefore often given a certain horizontal extension, which has also other advantages of great practical importance." In most cases the electrodes consist of metal wires 100 to 1,000 meters long, or more, arranged to come in contact with the ground for purposes of conduction. The distance between the wires is varied according to the depth to which it is desired to investigate. The greater the distance the greater is the depth attainable.

Lundberg gives tables to show that strong electrical "indications" correspond in most cases with ore, and weak "indications" with impregnations, though some strong indications correspond with impregnations which are too poor to classify as ore. The greatest difficulties, he says, are caused by impregnations of graphite, pyrite, magnetite, or specular iron which are halfway between being of value for mining and of no value at all because of their low metal content, though they often have good conductivity. Usually "indications" of impregnations, he says, can be distinguished from ore "indications," though not always.

"Contrary to what is often stated," says Lundberg, "the degree of moisture in the soil has little disturbing effect, and 'indications' are never caused by water." Metal objects such as pipes naturally cause perturbations in the electrical field. Electric power cables above ground do not, as their frequency is totally different.

The work of Lundberg and Nathorst is promising, marking as it does material progress in the science of electrical prospecting. Another recent step has been the extensive experiments of Schlumberger and Kelly with the "spontaneous polarization" method of the former, which involves the study of electric currents originating in the sulphide orebodies themselves. This method is simple and easily used where conditions are right, but will hardly prove as widely applicable as the other methods discussed which involve the artificial creation of an electrical field.

## Simplicity in Technical Journalism

ENGLISH is the medium of expression for by far the greater proportion of the recorded engineering achievements of the age; and we believe that the *Mining Journal-Press* is understood wherever English is spoken. Engineering English, moreover, should aim at a high standard of simplicity and brevity in presentation, to the avoidance of localisms understandable only by the few. In a desire for the destruction of minor hindrances to international co-operation in the free interchange of technical information we make a plea to our British colleagues that they consider the advisability of omitting the weird (to us) appendages that sometimes follow the names of those whose writings in current publications place them in the spotlight. In a recent issue of our esteemed contemporary, the *Mining Magazine*, we note an excellent article on a subject of particular interest to us—the "Oil Fields of the Los Angeles Basin"; but our perspective is confused by the caudal appendages to the author's name, which read as follows: "M.A., D.I.C., F.G.S., A.M.I.P.T." What two of these stand for one can guess, and we have

no doubt as to the local significance of all of them; but is so lengthy a justification of the professional standing of the author necessary, even assuming a general appreciation of the significance of such initials among the English-speaking peoples? However, we doubt whether all the appendages in question convey any meaning to the great majority of students in the subject, even in the British colonies.

We tremble at the possibility of error in deciphering the meteoric tails used by some of our British colleagues. Sooner or later we are sure that a grave error will be made in the print shop, if not in the editorial rooms. Only recently the name of a distinguished gentleman appeared in connection with an Indian mining enterprise followed by the mysterious initials "I.C.S."; whereupon in our ignorance we hastily credited him with receiving his education through the mails, from the International Correspondence Schools. The names of a few British engineers are seldom found separated from the appendage "O.B.E.," which to the initiated might mean the "Order of the Bad Egg." Joking apart, however, such abbreviations mean nothing whatsoever in the world of science and engineering achievement; and we believe that the day is not far distant when universal agreement will favor their abolition in technical journalism.

No one will deny the significance of membership in some of the learned societies or the worth of certain university degrees; but the caudal appendage test is not sufficient to permit a true appraisal of culture or achievement; the winner of a Nobel prize, for instance, retains the original simplicity of his designation. If the name of an author who contributes to current technical journalism does not carry sufficient weight, no amount of trimmings will save the situation. The test of greatness is the ease with which the name can be remembered and titles and decorations can be forgotten by posterity. And the most modest and effective manner in which such greatness may be anticipated is by the adoption of simplicity in matters of personal advertisement.

## Manufacturing Insulated Copper Wire in California

THE ECONOMY of manufacture of certain commodities in California is being recognized, and significant developments are taking place. In 1922 the first insulated wire factory west of Chicago was established at Orange, near Los Angeles. In 1922 the volume of business exceeded $1,500,000, and it is now realized that demand exceeds possible supply with existing equipment; and the owners, the California Wire Co., are planning extensions. A new unit is expected to be in operation in the near future, to increase output by 20,000 lb. per day, whereby a total of 100,000 lb. of insulated wire will be made per 24 hours.

To the north, at Oakland, announcement was made recently that the Illinois Wire & Cable Co., of Sycamore, Ill., plans the erection of the first unit of a plant to utilize about 20,000 lb. of copper per day in the manufacture of wire and cable.

These developments predict an increased use of copper, consequent on cheaper production of insulated wire. Further economies will result as soon as the wire can be drawn locally. Expansion of Coast industries of this nature will greatly facilitate the development of hydro-electric power and stimulate demand for copper.

## Ethics for Ex-Treasury Employees

RECENTLY, Secretary Mellon ruled that no former employee of the Treasury Department, until two years after his resignation, shall appear before the department in the capacity of attorney or agent in cases concerning which he had personal knowledge while serving the government; and in no other case except by special consent of the secretary. The announcement is explained by a statement that the employment turnover in the Revenue Bureau has been large, and that many have entered it for the purpose of equipping themselves for work for big corporations. It is likely, however, that the near-scandal growing out of cases involving huge refunds in which former officials of the government, large and small, served as special pleaders is one reason for the recent amendment of the regulations.

It may be argued that an employee has the right to resign at any time; that any experience he has obtained is a personal asset that he should be able to use; and that the government has no right to interfere with the selling of his specialized services in the best market. It may be contended that so long as there is no collusion between the ex-employee and his former associates who remain in the department, no valid exception can be taken to the appearance as special attorney of a former official.

We are inclined to believe, however, that Secretary Mellon is right in his action. The fact that the administration of the law depends so much upon interpretation, and that every case presents peculiarities that make different computations equally tenable, makes it possible to justify almost any readjustment of figures either up or down. In these circumstances proof of dishonesty or fraud would be impossible. The temptation for friends within and without the department to work together to the detriment of the government or of the taxpayer is unusually strong. Certainly it is not right for an ex-employee to take advantage of knowledge regarding a specific case, gained while on the government payroll, subsequently to press a claim for refund against the government.

Obviously, the best way to avoid similar trouble in the future is to simplify the law so that an accountant of average intelligence can prepare a tax return with reasonable certainty that it is correct. The revenue bill now before Congress is even more involved and complicated than the old one. Simplification and clarification are needed. It is not so easy to frame a simple law as it might seem, but as long as the present uncertainties exist, and huge amounts of money are involved, serious trouble will attend the administration of the law. The opportunity for irregularity will be too great a strain on human frailty.

Recent debate in the Senate centered around that section of the Revised Statutes which prohibits former government officials from pressing claims against the department in which they served, with reference to matters pending while they were in office, this prohibition lasting for two years. Application of this rule was considered in the case of the Ex-Secretary of the Treasury, Mr. W. G. McAdoo, who within two years after leaving the Treasury Department had engaged in a refund case. Senator Lodge, Republican, observed that this activity of McAdoo's was clearly in contravention of the law, while Senator Jones, Democrat, said he didn't know anything about it.

# An Opinion as to the Law on Assessment Work on Mining Claims in Alaska

By J. W. Thompson
Author of "United States Mining Statutes Annotated"

DIVERSITY OF OPINION exists as to the application of the law relating to performance of assessment work on placer mining claims in Alaska. This is true more particularly as to placer claims located under the act of 1912. By an act of July 6, 1900 (31 Stat. 321, page 329), all mining laws were "extended to the District of Alaska"; and thereafter all mining claims in that territory were on an equal footing with mining claims in the United States.

The first change in the law as related to Alaska was made by the act of March 2, 1907 (34 Stat. 1245), which permitted all holders of unpatented mining claims in Alaska to make proof of the performance of assessment work by affidavit. The act was special and remedial in its nature and had but the one purpose; but it was so worded that a claimant wishing to obtain advantage of its provisions must comply strictly with its terms and must file his affidavit within the time stated and in substance as required. If a claimant failed to do so his claim should "become forfeited and open to location by others."

The Circuit Court of Appeals for Alaska has held that a failure to perform assessment work within the year rendered the claim open to relocation, and that the right to resume work after the expiration of the year was denied a claimant, and that the act repealed this provision of the original Section 2324, Revised Statutes[1].

The next and most important change in the law was made by the act of Aug. 1, 1912 (37 Stat. 242).

## Abuses Lead to Restrictions

When the liberal policy of the government for acquiring and holding mining claims was found to be greatly abused in Alaska, and placer claims of large dimensions were being acquired and held for speculative purposes, and development of those located was not commensurate with the supposed richness of the mineral lands of that territory, Congress, by request of persons interested and upon a report by the Department of the Interior, presented to the Senate Committee on Mines and Mining, passed the special and restrictive act of 1912. This act differed from all existing laws in its application to placer claims in Alaska in the following, and perhaps other, particulars:

1. No association placer location should thereafter exceed forty acres.

2. No person or agent should locate more than two claims in any calendar month.

3. Every agent was limited to two principals for each month.

4. One hundred dollars' worth of work must be done annually on each twenty acres or fraction thereof.

5. The work must be done or the improvements made each year, "including the year of location."

6. The act only applied to placer claims thereafter located.

7. The length of any such claim should not be more than three times its width.

[1]Thatcher v. Brown, 190 Federal, 908.

The act, as shown by its title, was "to modify and amend the mining laws in their application to the Territory of Alaska." The act is more strict in its language than the mining statutes generally, and expressly makes void any location attempted in violation of the act. It shows on its face the necessity for the strictest compliance with its terms in order to obtain a valid location. Instructions of the Land Office say that "no placer claim can lawfully be located except in compliance with and under the limitation of the act." It shows a clear intention on the part of Congress to adopt an entirely new policy as to placer locations in Alaska, and it, in effect, lifted all such claims thereafter made out of the existing category of mining claims and placed them in a class to themselves. No other existing mining law could in anywise govern or affect the claims located under this act, except proof of performance of assessment work could be made under the act of 1907.

## Period for Doing Assessment Work Made to Start Jan. 1 After Location

In order to accomplish one of the purposes intended by Congress, the act restored, as to these particular claims, the rule that existed under Section 2324, R. S., as to the performance of assessment work for the year of the location of the claim, but it did not give locators the right to resume work after the expiration of the year, as did Section 2324. In this respect the principle stated by the Alaska Court of Appeals applies with equal and even stronger force to this act of 1912 than to the act of 1907. The rule applies to the year of location as well as to subsequent years, and under this act in both cases the work must be completed within the year or a claim is open to location, and the locator cannot resume the work after the expiration of the year.

Much confusion and litigation arose because of the want of uniformity in the commencement of the period for performance of assessment work on all claims, and Congress by act of Jan. 22, 1880 (21 Stat. 61), amended Section 2324, and made Jan. 1 succeeding the date of location the commencement of the period for doing assessment work on all mining claims, thereby making the commencement of the work correspond with the calendar year, and creating absolute uniformity as to the beginning of such period.

## Uniform Date Established

Under this amendatory act a locator could possibly have practically two years for the performance of his first assessment work, and by beginning on the last day of the year could extend the time by resuming work. This was another evil the act of 1912 was intended to remedy. The purpose of the amendatory act was to establish a uniform date for the commencement of the period for performing assessment work and to avoid the uncertainties and the litigation that had arisen under Section 2324, and to have the period begin and run with the calendar year[2].

Thus for more than forty years throughout the

[2]"United States Mining Statutes Annotated," 283, 284.

United States, and for more than thirty years in Alaska, the period for the performance of assessment work began on Jan. 1, after the date of location, and this was known as the "calendar year." But after the passage of this act in 1912, neither Section 2324 nor the amendatory act of 1880 in any way governed or affected placer claims in Alaska, which had been located under this later act. Placer locators in that territory have recognized this rule, and assessment work on such claims has been done wholly in accordance with the strict terms of this act of 1912, and proof thereof made under the remedial provisions of the act of 1907.

It is important to note, as will appear, that this act of 1912 is both local and special. This is influential, if not controlling, in its construction with a later act to be considered. A statute is special in the constitutional sense when by force of some limitation it arbitrarily separates some persons, places, or things, from others upon which, except for the limitation, it would operate.

Special laws are those made for individual cases, or for less than a class. Local laws are special as to place.[3] Measuring this act of 1912 by these rules, it is special because it is limited to placer locations in Alaska, thereafter made. Of the great mass of mining claims these are specified and singled out. It operates upon no others, so far as time and place are concerned. It is local for the reason that it applies to Alaska, only. But for the use of the words "in Alaska" it would apply to all placer locations thereafter made within the jurisdiction of Congress. It arbitrarily separates a particular place and some particular things from all other places and things upon which, but for the limitation, it would operate.

### Title of Act Denotes Application

The title of the act shows beyond doubt that it was intended to be both local and special, as it is to amend and modify the mining laws "in their application to Alaska."

[3]Lewis Sutherland Statutory Construction, sections 195, 196, 199.

## According to Mr. Thompson

**1. The act of March 2, 1907, is not repealed by the act of 1912, and is still in force.**

**2. Proof of assessment work on all mining claims in Alaska may be made by affidavit, pursuant to the provisions of this act.**

**3. The act of Aug. 1, 1912, does not repeal or in any manner affect or change the act of 1907.**

**4. The act of 1912 is not repealed or in any way or manner changed or affected by the act of 1921.**

**5. The act of 1912 is special legislation for particular purposes and applies only to placer claims in Alaska located subsequent to the date of the act.**

**6. The act of 1912 has no application to placer locations located before its enactment, and has no application to lode claims in Alaska.**

**7. Under the act of 1912 the period for performing assessment work on placer claims located under its provisions dates from the day of location of each claim.**

**8. The "calendar year" rule has no application to placer claims located under the act of 1912.**

**9. Assessment work on placer claims located under the act of 1912 must be performed for the year of location and must be completed before the expiration of the year, or the claim is open to relocation.**

**10. The act of Aug. 24, 1921, does not in any manner repeal, modify, or affect the act of 1912.**

**11. The act of 1921 has no application to the performance of assessment work on placer claims located in Alaska under the act of 1912, but it does apply to all other mining claims in Alaska, as well as elsewhere.**

**12. The acts of 1907, 1912, 1921 are all valid and subsisting acts, and the three together constitute a complete and harmonious mining code for Alaska.**

The more important and the more difficult question arises upon the construction of the act of Aug. 24, 1921 (Chap. 84, Stat. 1921). The question is whether this act repeals, in whole or in part, the act of 1912. Under this act are placer locators in Alaska given from July 1 to July 1, each year, for performing their assessment work? It can by no means be claimed that this act relieves such claimants from doing the work for the year of the location of a claim. The unreasonableness in assuming that the act does apply to claims located under the act of 1912, and that after the first year the period for assessment work does extend from July to July, may be seen by supposing that a person should ignorantly or thoughtlessly locate a claim on June 1 of any given year. He must do his assessment work for the year of his location, and as seen, *supra*, he must complete it before the year expires, or his claim is open to relocation by another. If the new year begins July 1 following, then he must do one of two things: either he must perform the work for the year of location, and complete it before July 1, or he must perform and complete the assessment work for the two years in thirteen months. Either of these would be an unusual hardship, and in the first event practically impossible. Such a construction of the act would place undue burdens on locators and reduce the statute to an absurdity. It is a familiar rule that the construction of a statute that reduces it to an absurdity is to be avoided. It is also the rule that a statute must not be so construed as to injure or harm those subject to it. The intention of the legislative body must be presumed to have been to benefit, not to injure, those interested in the subject of the law[4].

This act of 1921 must be construed in the light of the purpose for which it was enacted, according to the wording, the legislative intent, and with the act of 1912, unless there is a positive repugnance between the acts.

The title says: "An Act Changing the period for doing the annual assessment work on unpatented mineral claims from the calendar year to the fiscal year, beginning July 1, each year." After the enacting clause

[4]Harris v. Ball, 250 Federal 209, p. 217.

it reads: "That Section 2 of 'An Act to amend sections 2324 and 2325, of the Revised Statutes of the United States concerning mineral lands,' approved Jan. 22, 1880, be amended," etc. It then provides that the period within which the work required to be done annually on all unpatented mineral claims located since May 10, 1872, "including such claims in the territory of Alaska," shall commence at 12 o'clock meridian on July 1, succeeding the date of location of such claim.

The report made on the bill by the House Committee on Mines and Mining says: "The sole object of this bill is to change the time for performing the work required to be done annually on unpatented mining claims from the *calendar* to the *fiscal* year." The reason given in the report for the change was that work was usually delayed until the last months when the weather had become cold in the mountain regions, and in many cases claims would be covered with snow. The demand for the change was said to be quite general. But such change would not be necessary to avoid this particular difficulty in Alaska, as to claims located under the act of 1912. It could not be anticipated that locators of such claims in Alaska would make locations at such times as would render it inconvenient or impossible to perform the work. Each locator held within his own hand the means of escaping this difficulty, as the year for doing the work dated from the day of location. The act of 1912 automatically regulated this matter by requiring the work for the year of location without fixing a definite or uniform period for the commencement and termination of the year.

It is claimed in some quarters that because this act expressly says "including such claims in Alaska," it must be conclusively taken to include all placer claims located under the act of 1912. If at the time of this enactment there had been no mining claims in Alaska except those located under the act of 1912, the argument might be sound; but it was well known by Congress that there were other claims in Alaska, both lode and placer. Congress had in 1900 extended all the mining laws to that territory, and it may be assumed that Congress understood that it was necessary by some such expression to make this act operate on any claims in Alaska, and that these special words were required to do so. It must be observed that the act uses the words "such claims." All lode claims and all placer claims located prior to the act of 1912 were subject to the calendar year rule for assessment work and the act must be extended to Alaska in order to reach both classes of these claims, as it changed the commencement of the period for doing work on these claims. As to these, the law was changed from the calendar to the fiscal year. Both lode and placer claims prior to 1912 were regulated and controlled by the act of 1880, and these were the "such claims" as must necessarily be referred to in this act of 1921. The expression "such claims" dispensed with the necessity of referring to the two classes of claims that were subject to and controlled by the act of 1880.

The word "such" is defined: "Of that kind; of the like kind or degree; like; similar." Also: "The same as previously mentioned or specified." And: "Of that class." Also: "used to indicate or suggest a person or thing originally specified by a name or designation[5]."

The "such claims" of this act must accordingly refer to claims in Alaska "of that class" about which Congress was legislating, and that class must mean all claims the assessment work on which was required to be performed during the calendar year, and which Congress was changing to the fiscal year.

The act, as the title shows, had but one purpose, and as this one is expressly stated no other can be implied or inferred. This purpose was to change the commencement of the period for performing assessment work "from the calendar year to the fiscal year." But placer claims located in Alaska under the act of 1912 were not and could not be included in any class of claims governed by the statute fixing the fiscal year as the beginning of the period for performance of assessment work, and as only "such claims" as were governed by the act of 1880 could be included in this act of 1921 that amended the act of 1880, in the particular respect noted.

A "calendar year" means the year from Jan. 1 to Dec. 31, and not a period of twelve months commencing at any fixed and designated month and terminating with the day of the corresponding month in the next succeeding year[6].

### No Reason for Changing Act of 1912

Can it be assumed that Congress intended or desired to change the law relating to placer locations in Alaska, located under the act of 1912? That act was the last expression of that body relating to that class of claims; the law had been enacted upon request of persons interested in conserving the minerals of Alaska; it had succeeded in accomplishing all that had been desired, and there was no showing of any unrest or desire for a change in any particular. As to all other claims in Alaska, there may have been, and certainly was, the same desire to have a change in the period for performance of assessment work, as in the United States. Indeed, it would seem that the desire for the change would be greater in Alaska than in the United States, and Congress naturally desired to have the law operate in that territory as to lode claims and as to placer claims located prior to the act of 1912, and it did, by the expression found in the act, the very thing that would make the law so act, and without some such words the act would not have operated in Alaska. The fair inference is that Congress did not intend to disturb the class of claims about which it had more recently legislated and concerning which the legislation seemed to be satisfactory.

### Act of 1921 Has No Repealing Clause

It is important to note that this act of 1921 has no repealing clause. If then it repeals or changes any part, or all of the act of 1912, it must be held to do so by implication. It does not appear how it could repeal or change part with reference to the performance of assessment work without changing or repealing all of it as to that particular point. Just how it could repeal the part for the commencement of the period for such work without repealing the provision requiring the work to be done for the year of location is not apparent.

Repeals by implications are not favored, and are never admitted where the former or existing act can stand with the new one. There must be a positive repugnancy between the provisions of the new and those of the old law, and even then the old is repealed only to the extent of the repugnancy. If by any reasonable construction the two statutes can stand together, they must so stand[7].

[5]Century Dictionary.

[6]Carroll v. Wright, 131 Ga., 728; 63 S. E., 260.

[7]Chow Hoong v. United States, 112 U. S., 536, p. 549.

Repeals by implication are not favored in law, and especially where the effect would be to repeal a prior particular act by a general one*.

### Acts of 1907, 1912 and 1921 a Harmonious Code for Alaska

The conclusion seems clear, on reading these acts together, and considering the purpose for which each was enacted, the objects to be accomplished, and the results to be obtained, that each can be upheld and that the two can stand together, and that there is no positive repugnancy between the provisions of the two laws. On the contrary, violence is done to the language, and outrage is committed upon the intention of the legislative body, if they are not held to be in perfect accord and that the two acts, together with the act of 1907, make a full, perfect, and harmonious mining code for the Territory of Alaska.

It has sufficiently been made to appear that the act of 1912 is a special law, special as to a class of claims, and local as to place—Alaska. It is equally clear that the act of 1880, and this amendatory act of 1921, are general laws, intended by their provisions to apply to all classes of claims and without limitation as to place. In view of these propositions certain well established rules of construction apply. These rules or governing principles may be stated as follows:

Special statutes will not be repealed by general enactments, nor will general enactments apply in the interpretation of special statutes.—State v. Benson: Wash., 189 Pacific 1000.

A rule adopted by courts is to the effect that where there is one general statute and one local or special statute, on the same subject, in conflicting terms, neither abrogates the other, but both stand together; one furnishing the rule for the particular locality or thing, and the other for the unexcepted place and instances, and it is immaterial which is the later in date.—State v. Beard: Nev., 29 Pacific 531.

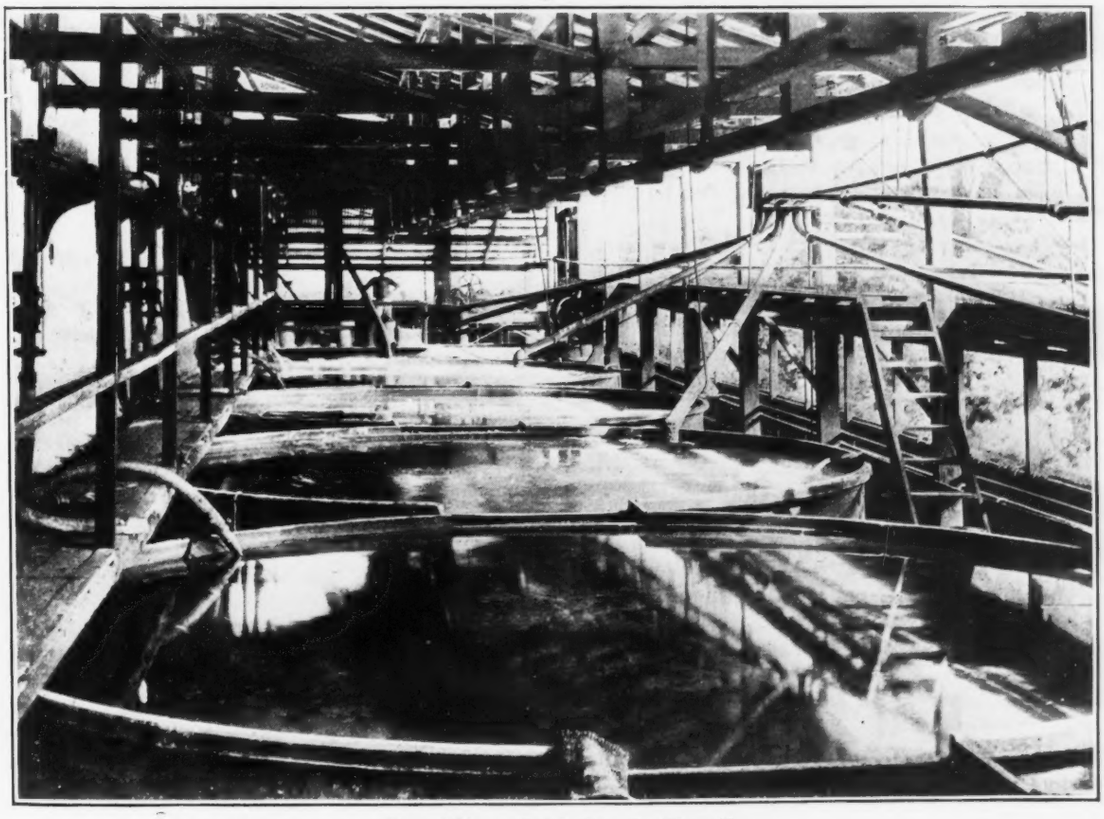
"The rule is that a general law, or the mere re-enactment of a general law, will not repeal a special act by implication."—State v. Commissioners of Public Lands: Wis., 82 N. W. 549.

"The special stands, untouched by a later statute of general application, unless the purpose to destroy the special scheme is unmistakably declared."—Ryan v. City of New York: N. Y., 126 N. E. 351.

A general act is not to be construed to repeal a previous particular act, unless there is some express reference to the previous legislation on the subject, or unless there is a necessary inconsistency in the two acts standing together. The reason for this rule is that the legislature having had its attention directed to a special subject, and having observed all the circumstances of the case and provided for them, does not intend by a general enactment afterwards to derogate from its own act when it makes no special mention of its intention to do so.—Crow Dog, Ex Parte: 109 U. S. 516, p. 520; Goodson v. United States: Okla., 54 Pacific 423, p. 430; United States v. Sampson: 19 App. Cas. (D. C.) 419.

"It is a cardinal rule of the construction of statutes that specific legislation in relation to a particular class or subject is not affected by general legislation in regard to many classes or subjects, of which that covered by the specific legislation is one, unless it clearly appears that the general legislation is so repugnant to the special legislation that the legislators must be presumed to have intended thereby to modify or repeal it; but the special and the general legislation must stand together, the former as the law of the particular class or subject, and the latter as the general law upon other subjects or classes within its terms."—Harris v. Ball: 250 Federal 209, p. 216 (citing many cases).

*Goodson v. United States: Okla., 54 Pacific, 432, p. 430.



**Cyaniding Gold Ore in Brazil**

*The Ouro Preto Gold Mines has a well-equipped mill and cyanide plant in Minas Geraes*

# Some Facts About Teapot Dome

*A Review from an Engineer's Standpoint of the Conditions Surrounding the Sinclair Lease*

By H. A. Wheeler
Consulting Mining Engineer, St. Louis, Mo.

ALTHOUGH the Teapot Dome contract is being actively discussed throughout the country and is under searching investigation at Washington, the misinformation about it is appalling, even in places where reliable data should be expected. The layman may be pardoned for his distorted views because of his lack of technical knowledge, and the politicians are determined to exaggerate the news that is favorable to their party, but technical men should at least be clear as to the facts and sanely interpret them, in spite of the general hysteria prevailing that is being fostered by designing politicians.

The gravest confusion concerning the Teapot mess is the lack of agreement as to whether drainage had occurred from adjoining wells, before the Sinclair contract was signed. Some experts claimed that neighboring wells had so heavily drawn from the land now covered by the Sinclair contract that its estimated potential yield of 100,000,000 to 200,000,000 bbl. had been reduced to less than 25,000,000, whereas other experts claimed that there had been no drainage.

Before considering this inconsistency, it is necessary to review conditions at the Teapot and the adjoining Salt Creek domes.

## Salt Creek Dome, Adjoining Teapot, a Heavy Producer

The Salt Creek Dome is an unusually strong, well-defined structure at the northern edge of Natrona County, Wyo., that courses north and south, with a length of 10 miles and 5 miles wide. The crest of the structure, as contoured on the Wall Creek sand, is at 3,900 ft., with a closure of 2,000 ft. at the north end and 1,000 ft. at the south end (adjoining Teapot Dome), as per the 1918 structure map by C. H. Wegemann in U. S. Geological Survey Bulletin 670. Oil seeps were known as far back as 1880 and the first well was drilled in 1889. As it is 45 miles from a railroad and in a desert country, developments proceeded very slowly until 1911, when a pipe line was built to Casper, where two small refineries were erected. By 1917, the daily production had increased to 10,000 bbl., and since then the growth has been more rapid, as refining facilities at Casper have greatly increased. By 1923, the Salt Creek field had a daily maximum output of about 175,000 bbl., but from lack of sufficient pipe lines, the wells were partly shut in and the new 20,000-bbl. Sinclair pipe line is greatly needed. Today there are about 900 wells, of which about 690 are in the second Wall Creek sand, about 130 are first Wall Creek wells, and 66 are erratic shale wells. The December output averaged 118,000 bbl. daily and about 24 per cent of the wells are in the pump. The *average well yield is 250 bbl.*, which is very high for an old field, and it is high-grade paraffin oil.

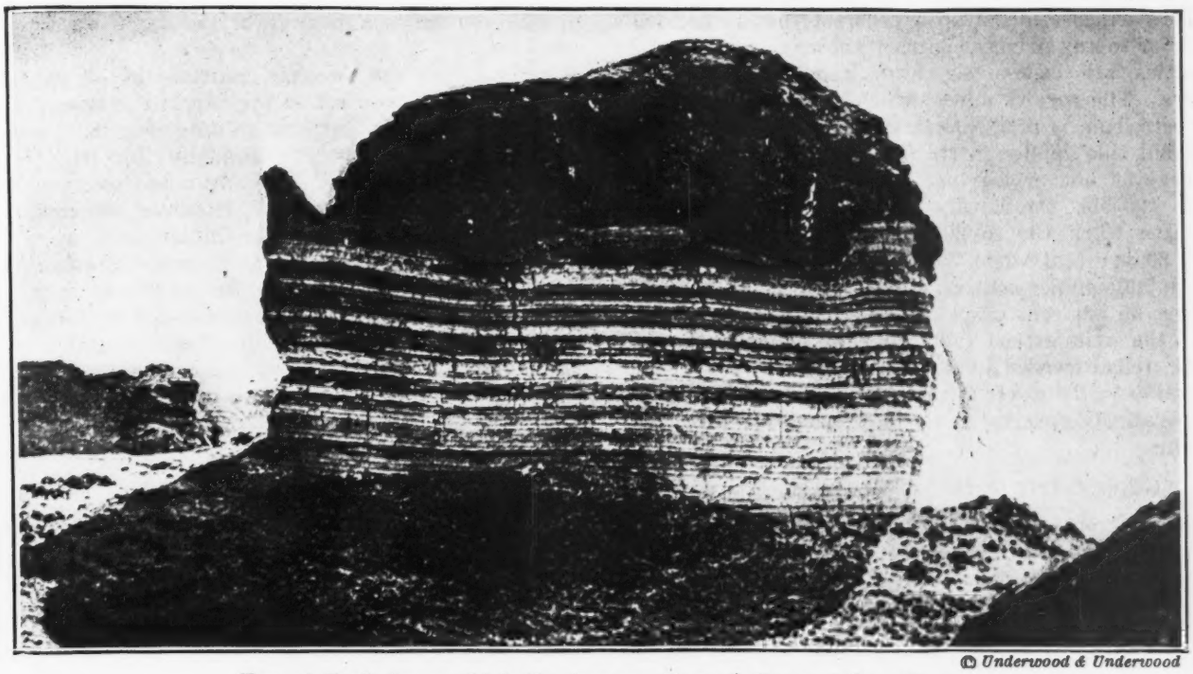
The pool covers about 22,000 acres—it is unusually large—and there are more than thirty operators. The Salt Creek field today is probably the richest high-grade field in this country, and as it averages only one well to thirty acres, it should have a long life. The yield per acre is about 20,000 bbl., which is extremely rich, and no dry holes have been drilled on the structure.

It was the unusual richness and magnificent staying power of the Salt Creek pool that caused the Sinclair company to make a contract in April, 1922, for the Teapot Naval Reserve on terms that most oil men regard as too high, and few, if any, oil men would have taken the contract off his hands in 1922 even before the fact was brought out by the subsequent drilling that it is very much poorer than the adjoining Salt Creek Dome.

The Teapot Dome lies a mile southeast of the Salt Creek Dome, with an intervening saddle or depression which on the Shannon sand shows a closure of 400 ft., according to C. H. Wegemann's report in 1911 in U. S. Geological Survey Bulletin 452 and which in his later 1918 map (U. S. Geological Survey Bulletin 670) shows a closure or saddle of about 200 ft. as contoured on the Wall Creek sand. With a closure of 200 ft., most geologists would regard this as a sufficient seal to prevent drainage of oil from the Teapot Dome by wells on the Salt Creek Dome. When in 1915 the Teapot Dome was reserved for the Navy, it was difficult to define the limits of this intervening, separating saddle, so the boundary of Naval Petroleum Reservation No. 3 was made to not only cover all the Teapot Dome, but was extended up on the south flank of the Salt Creek Dome, so as to be sure to include the saddle. It is this extension or overlapping onto the Salt Creek Dome that has undoubtedly been drained, and this overlap comprises about 15 per cent of the area of the reservation. That the Teapot Dome proper—the Teapot structure—had been drained prior to the lease is improbable, but there is a widespread misconception that the Sinclair lease covers only the Teapot structure, *whereas it covers all the Teapot Dome and part of the southern flank of the adjoining Salt Creek Dome,* and the latter has been more or less drained by neighboring wells on the Salt Creek Dome.

## First Estimates of Teapot's Richness Too High

The Teapot Dome is a much smaller, very much weaker structure than the Salt Creek Dome. It courses southeasterly and has a length of 7 miles and a width of 2½ miles. The crest of the Wall Creek sand rises only to 2,900 ft., as compared with 3,900 ft. on the Salt Creek Dome 6 miles distant; its closure at the north end is only 200 ft. and at the south end 900 ft. Judging by the contour map on the Wall Creek sand in the 1918 Wegemann report, which shows that the Teapot structure is the southerly tapering off of the big, strong Salt Creek structure, a geologist would predict before either had been drilled that the Teapot structure would be decidedly inferior to the Salt Creek Dome. The seventy-six wells drilled to date emphatically confirm this estimate. If the Salt Creek Dome contains 500,000,000 bbl. of recoverable oil (some have guessed 750,000,000), it was a highly optimistic guess that estimated a 200,000,000-bbl. yield from the Teapot Dome



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*Teapot Rock, from which the famous Teapot Dome takes its name*

and the recent estimates of 10,000,000 to 25,000,000 bbl. are likely to be much nearer its ultimate output from the known sands (Shannon and second Wall Creek).

To date, seventy-six wells have been drilled on the Teapot Reservation, of which sixty-one are oil producers, eleven are gas wells and four dry holes. Of the sixty-one wells, twelve are shale wells at 1,000 to 2,000 ft. and the remainder are in the second Wall Creek sand at 2,700 to 3,000 ft. Although the wells are less than a year old, over 50 per cent are pumpers, whereas only 24 per cent are pumpers in the adjoining Salt Creek pool that has been producing over twelve years. The wells average about 70 bbl. daily, as compared with 250 bbl. in the *old* Salt Creek field, and the total daily output has ranged from 3,700 to 4,700 bbl. The first Wall Creek sand has proved barren (full of salt water), and thus far no test has been drilled to the Lakota sand, at about 4,000 ft., which may be more prolific and increase the productive area.

Drilling started at the north end of the Reservation, on the flank of the Salt Creek Dome, where one well came in at 8,000 bbl., and other wells ranged from 6 to 700 bbl. A shale well started at 15,000 bbl., but like wells in the shattered shale, its flush production was very brief and it is now a small pumper.

As the drilling progressed southward, toward the Teapot Dome, oil was found at the base of the saddle, so that the oil in the second Wall Creek sand is a continuous sheet from the Salt Creek Dome on the Teapot Dome. This is a highly favorable interesting geologic fact that suggests that either the evidence was not complete or authentic as to the closure caused by this saddle (which would usually be expected to produce salt water), or else that the feeding field was so great as not only to fill both the Salt Creek and Teapot domes, but also the intervening saddle. This continuity of the Wall Creek sand across the saddle would eventually result in more or less drainage from the Teapot structure, when the Salt Creek Dome is more heavily drilled, had no lease been executed by the government.

The crest of the Teapot Dome is mainly a gas field that produces wells yielding from 7,000,000 to 60,000,000 cu.ft. of gas per day.

In the recent Senate committee report by F. G. Clapp, petroleum geologist of New York, the Teapot *reservation* is estimated at 9,300 acres, of which he regards 5,600 acres as barren of oil or gas, 1,400 acres as gas-bearing, and only 2,300 acres as oil-bearing. Of the latter, 1,600 acres are on or north of the saddle—on the flank of the Salt Creek Dome—and hence have been subjected to drainage. These estimates are subject to revision, as later evidence is obtained by drilling.

A review of the above data shows:

1. That the Teapot Lease or Naval Reservation No. 3 covers all of the Teapot Dome and about 1,500 acres additional territory on the south flank of the adjoining Salt Creek Dome.

2. The 1,500 acres, more or less, on the Salt Creek Dome was subject to drainage by neighboring wells when the lease was executed.

3. The Teapot Dome, an independent structure a mile distant from the Salt Creek Dome, was virgin undrilled territory that probably had not been drained by the wells on the Salt Creek Dome, but eventually would be more or less affected when the Salt Creek pool is more heavily drilled, as the second Wall Creek sand is a continuous sheet of oil-bearing sand from the Salt Creek Dome to the Teapot Dome.

It is not my intention to discuss the political capital that wily vote getters are trying to extract from the Teapot Dome miasma, but I suggest that if the facts can ever be obtained from the prejudiced investigators at Washington they will show that ex-Secretary Denby has been wilfully slaughtered in trying to exchange un-usable oil that was being drained at 3,000 ft. and 50 per cent of which is only fit for the Navy after extracting the lighter products, for fuel oil that is 100 per cent usable in sea-coast tanks. Even ex-Secre-

tary Fall, who seems to have feathered his nest at the public's expense, drew up a contract that is decidedly superior to any private contract known to me. For the royalties are excessively high and the terms very severe. The royalty under which about 90 per cent of the petroleum is produced in this country is one-eighth (⅛), but this applies in the Teapot Lease to wells that average 50 bbl. or less per day. For wells averaging 50 to 100 bbl., the royalty is one-sixth; the royalty is one-fifth when 100 to 200; 25 per cent when 200 to 300; 30 per cent when 300 to 400; 35 per cent when 400 to 500; 40 per cent when 500 to 600; 42½ when 600 to 800; 45 per cent when 800 to 1,000, and 50 per cent when the wells exceed 1,000 bbl. As many of the Salt Creek wells exceeded 1,000 bbl., the lease was extremely favorable to the government when executed before the comparatively poverty of the field had been proved by drilling.

### Government Obtained Favorable Terms

The contract is favorable to the Sinclair company in permitting royalty oil to be exchanged for fuel oil, barrel for barrel, but it is fuel oil that the Navy wants —not crude—and it is delivered at the seaboard, not 2,000 miles inland. If the government takes cash for its royalty oil, it elects either local or Mid-Continent prices, and as the latter were 75c. a barrel higher than Wyoming prices when the contract was made, the government obtained 40 to 50 per cent more from the sale of its royalty oil than neighboring private operators. Rapid development is required, or twenty wells in the first six months, and as they average about 3,000 ft., the cost will run at least $40,000 per well. An 8-in. pipe line over 800 miles long was demanded that will cost about $15,000,000, and this is about completed. Until the recent Washington explosion, the Sinclair company is reported to have faithfully lived up to its contract and has probably expended approximately $25,000,000, as it has had to build towns and water works and go to unusual outlays in building up working camps in a desert country that is 45 miles from Casper, the nearest railroad point, in a region whose severe winter weather renders drilling impracticable for three or four months. Now that drilling has indicated that Teapot is a lemon, it is not unlikely that the Sinclair company will be only too glad to be relieved of this white elephant, and any new contract will have to be on a more favorable basis to attract oil operators.

The contract was severely criticised by oil operators in having been awarded to the Sinclair company without competitive bidding, and as the government secures $5,000,000 to $10,000,000 annually for the Osage Indians, as bonuses, at duly advertised auctions, this appears to be a just criticism. However, the conditions are radically different, as the Indian land is sold in tracts of 80 to 160 acres that permit the small operators to bid on them. The Teapot Dome land was reserved to furnish oil for the Navy, and until drainage began to exhaust the reservoir, it was valuable when, as, and if extracted by drilling and shipped to the seaboard *after refining*. When the U. S. Bureau of Mines and former Secretary Denby realized that drainage was exhausting the reservoir, which would increase with the rapid drilling up of the Salt Creek field, it was decided to prevent further drainage loss by leasing the reservation and exchanging crude royalty oil for finished fuel oil *at the seaboard*, where it was actually available for the Navy. Had the reserve been cut up into small tracts, so as to be available to all operators, it would have resulted in a very rapid development that would have caused overproduction, and very few companies have the financial ability to secure pipe-line facilities to the seaboard. It was far wiser to lease the reserve as a large, single unit to a concern strong enough to carry out the very costly requirements of the government, as it would then be slowly drilled up without the curse of line fights and off-set drilling. Outside of the various Standard companies, which the public largely but unjustly regards with suspicion, there are only four or five companies of sufficient financial strength to carry out the terms of the contract. That the Sinclair company was selected is not surprising, as outside of the Standard companies it was better equipped with inland and seaboard refineries, with far less pipage to build, than the few big companies capable of assuming such a huge undertaking. And Mr. Sinclair seems to have been so confident of his superior position that he apparently sweetened the palms of an important politician with only $100,000, which was a bagatelle in consideration of the expected richness of the Teapot Dome at the time the contract was made.

**Pumping Eighteen Wells at Once from a Central "Power" Plant, Flatrock Pool, Oklahoma**

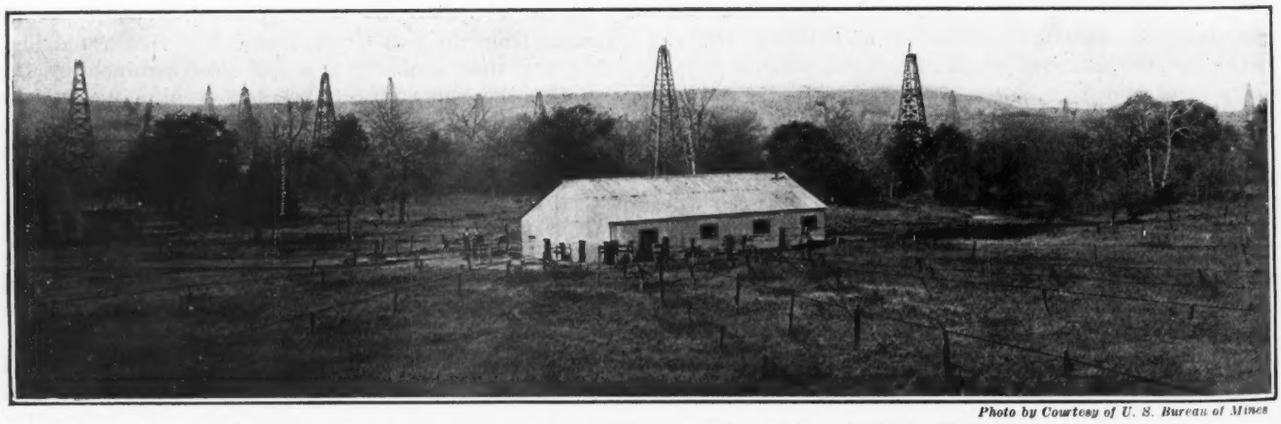


*Photo by Courtesy of U. S. Bureau of Mines*

*The radial arrangement makes possible operation with relatively little power. Three-quarter-inch rods are used for these jack lines*

# Prospecting for Disseminated Copper by a Study of Leached Croppings

## *Results of an Investigation Made to Discover Criteria for Distinguishing Favorable From Unfavorable Ground*

**By Charles Henry White**
Consulting Geologist, San Francisco, Calif.

MINERALIZED surface croppings have served in a general way as a guide to ore since mining became an art, prospectors early realizing that mineralized areas are more likely to contain valuable deposits than the unaltered surrounding country rock. Ore hunters have not been able, however, to identify readily within the mineralized area the more favorable locations on which to begin exploration.

If the metal sought is insoluble and therefore persists near the surface, inexpensive and well-established methods are available for the easy discovery of its richest croppings. If, however, the desired metal is soluble and has been leached from the capping for a considerable depth, and especially if the mineralized area is large, the finding of the most favorable location to begin development is often difficult and expensive. This has been a vital problem to operators in disseminated copper districts, and the lack of a satisfactory technique for this purpose has often led to costly and unproductive exploitation.

This paper gives an account of an investigation made for the purpose of discovering criteria to distinguish favorable from unfavorable ground, and sets forth the results obtained by the application of the technique developed. The material on which this study began, and the outcome of a series of tests made upon it to show the status of the art of judging croppings at that time, were described by Augustus Locke in 1922[1].

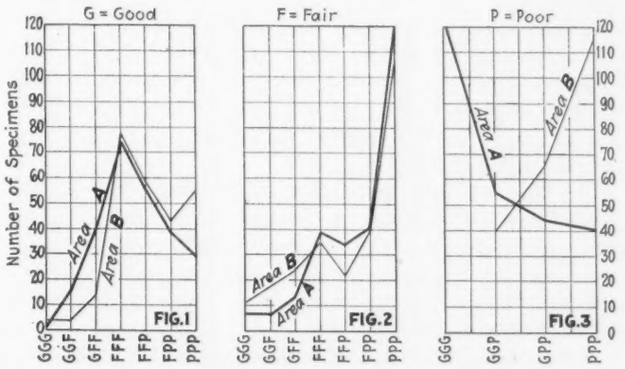
As explained in his paper, about 250 specimens of croppings were systematically collected from each of two eight-acre lots: one, designated as Area A, was the surface superjacent to a developed orebody; the other, Area B, with croppings similar in appearance to those of A, was the surface of proved pyritic, non-ore-bearing ground. The specimens were numbered in such a way that their origin could be established only by reference to a key. Six geologists, independently and in succession, undertook to classify the specimens into three grades, "good," "fair," and "poor," to see if a majority of those rated "good" would be from Area A, and a majority of those rated "poor" from Area B. The whole suite of specimens was rated three times in this way by each geologist. The results were very discordant and unsatisfactory, and showed, as was pointed out in the paper above referred to, that "despite the experience of all these men in judging disseminated capping, their foundation, at least in part, was grossly unscientific."

In consequence of this system of rating—classification into three grades at three different times—the whole suite would ordinarily be distributed among the seven different classes shown in Table I, running from the highest—those rated "good" three times (GGG)—to the lower, or those rated "poor" three times (PPP). The results of the ratings by me at that time are given in the following table. They are also shown graphically in Fig. 1.

**Table I—Classification of Specimens in First Test**

| Class | 1 GGG | 2 GGF | 3 GFF | 4 FFF | 5 FFP | 6 FPP | 7 PPP |
|---|---|---|---|---|---|---|---|
| Number of specimens in Area A | 1 | 16 | 41 | 75 | 55 | 38 | 29 |
| Number of specimens in Area B | 4 | 4 | 14 | 77 | 58 | 43 | 55 |
| Totals | 5 | 20 | 55 | 152 | 113 | 81 | 84 |

Number of specimens in Area A rated "good" at least once in three trials, 58
Number of specimens in Area B rated "good" at least once in three trials, 22
Number of specimens in Area A rated "poor" at least once in three trials, 122
Number of specimens in Area B rated "poor" at least once in three trials, 156
Number of specimens rated the same three times, 241. Percentage consistency 47.2.




*Figs. 1, 2 and 3—Charts giving results of three different classifications made of 520 cropping specimens by the author*

These results suggested to me the possibility of distinguishing Area A from Area B, if I went to the property and classified in this manner croppings' specimens in sufficient number from the two areas. I realized, however, that my criteria were not well established and that my partial success was probably due to a skill in detecting differences in characteristics, acquired unconsciously, through many weeks' prior study of similar suites of specimens from several of the Southwestern disseminated copper districts. My desire to make a test in the field could not be gratified until a year later, and during the interval problems of an entirely different nature claimed my attention.

### Test Repeated With Microscope

Before going to the field it was essential, therefore, to repeat the test on the same material and in the same manner as before. In making the second test, however, the binocular microscope replaced the pocket lens used in the first trial. As the work in the second trial progressed, the distinguishing characteristics became more sharply defined, the criteria more definite, and the specimens were rated with increasing confidence and consistency. The results of this test are given in Table II on the following page, and are shown graphically in Fig. 2

[1]Locke, Augustus: "Experiment in Ore-Hunting Geology." *Mining and Metallurgy*, April, 1922, p. 27.

**Table II—Classification of Specimens, Using Microscope**

| | GGG | GGF | GFF | FFF | FFP | FPP | PPP |
|---|---|---|---|---|---|---|---|
| Area A | 7 | 7 | 13 | 39 | 34 | 41 | 120 |
| Area B | 11 | 18 | 24 | 35 | 22 | 40 | 109 |
| Totals | 18 | 25 | 37 | 74 | 56 | 81 | 229 |

Number of specimens in Area A rated "good" at least once in three trials, 27
Number of specimens in Area B rated "good" at least once in three trials, 53
Number of specimens in Area A rated "poor" at least once in three trials, 195
Number of specimens in Area B rated "poor" at least once in three trials, 171
Number of specimens rated the same three times, 321. Percentage consistency 61.7.

It will be noted that these results are an exact reversal of the first. More than half of the specimens that were rated "good" came from the poor area, and more than half those rated "poor" came from the ore area. It was evident, therefore, that in the first trial, a year before, the criteria were not consciously recognized and permanently established in my mind, and that in the second trial I considered as favorable to ore the characteristics, in part at least, which I had regarded as unfavorable in the first, and vice versa. The second trial, however, served to prove that characteristics did exist upon which the specimens could be repeatedly and consistently separated into classes. It only remained to find which, if any, of the easily discernible characteristics indicated ore. Accordingly the whole collection was separated into the two groups A and B, and a systematic comparison was carried out to discover the characteristics peculiar to each group.

Before making this systematic examination, I inspected carefully a collection from the sulphide zone, chiefly ores, to find possible suggestions of what should be expected in the leached croppings. The following features were noted:

1. The chief *primary* sulphide remaining is pyrite.
2. Chalcocite enrichment consists of only a thin coating on the primary sulphide; therefore, if the primary sulphide is in coarse bunches the relative enrichment is small, but if it is in small disseminated particles, replacement may be complete.
3. Coarse primary sulphides are often associated with bunches and veinlets of quartz.
4. The richest ore is associated with the feldspathic elements of the rock, rather than with quartz.

The next step was to predict what kind of a cropping this ore would make through weathering and leaching if erosion carried away all the present capping. Without going into too great chemical detail, let us consider what results are to be expected when, in the cycle of erosion, oxidizing conditions prevail in this orebody:

1. Pyrite will be converted into ferrous sulphate and sulphuric acid, and, if oxygen is abundant, the ferrous to ferric sulphate. If the pyrite is in a quartz (neutral) environment and the supply of oxygen is limited, the iron goes away in solution leaving a cavity; if in a basic (alkaline) environment, the bases will combine with the sulphate radical, leaving the iron as limonite in place of the pyrite.
2. Chalcocite associated with oxidizing pyrites is carried away in solution; the condition of the voids remaining will depend upon the ratio between chalcocite and primary sulphide.
3. The color of the cropping will vary from the pure white of kaolin to dark reds and browns of limonite, the latter being a rough indicator of a possible minimum of pyrite.

The classification and tabulation of characteristics found in the two groups of croppings' specimens verified the predicted effects of oxidation and leaching on both greatly enriched ore and on slightly enriched protore. The tabulation of the characteristics described in the preceding paragraphs indicated that sufficient criteria had been established to serve as a basis of classification. I therefore mixed the whole suite of specimens consisting of the two groups A and B and rated each specimen either "good" or "poor"—that is, I referred it either to Area A or to Area B on the basis of the newly developed criteria. The classification was repeated a second and a third time, with results given below and shown graphically at Fig. 3.

**Table III—Reclassification Based on New Criteria**

| | GGG | GGP | GPP | PPP |
|---|---|---|---|---|
| Specimens in Area A | 121 | 55 | 44 | 41 |
| Specimens in Area B | 40 | 40 | 66 | 117 |
| Totals | 161 | 95 | 110 | 158 |

By the first classification in this third trial 66.5 per cent of the specimens were correctly referred to their source; in the second, 66 per cent; and in the third, 65.8 per cent, the average being 66.1 per cent.

## Croppings at Mine Studied and Mapped

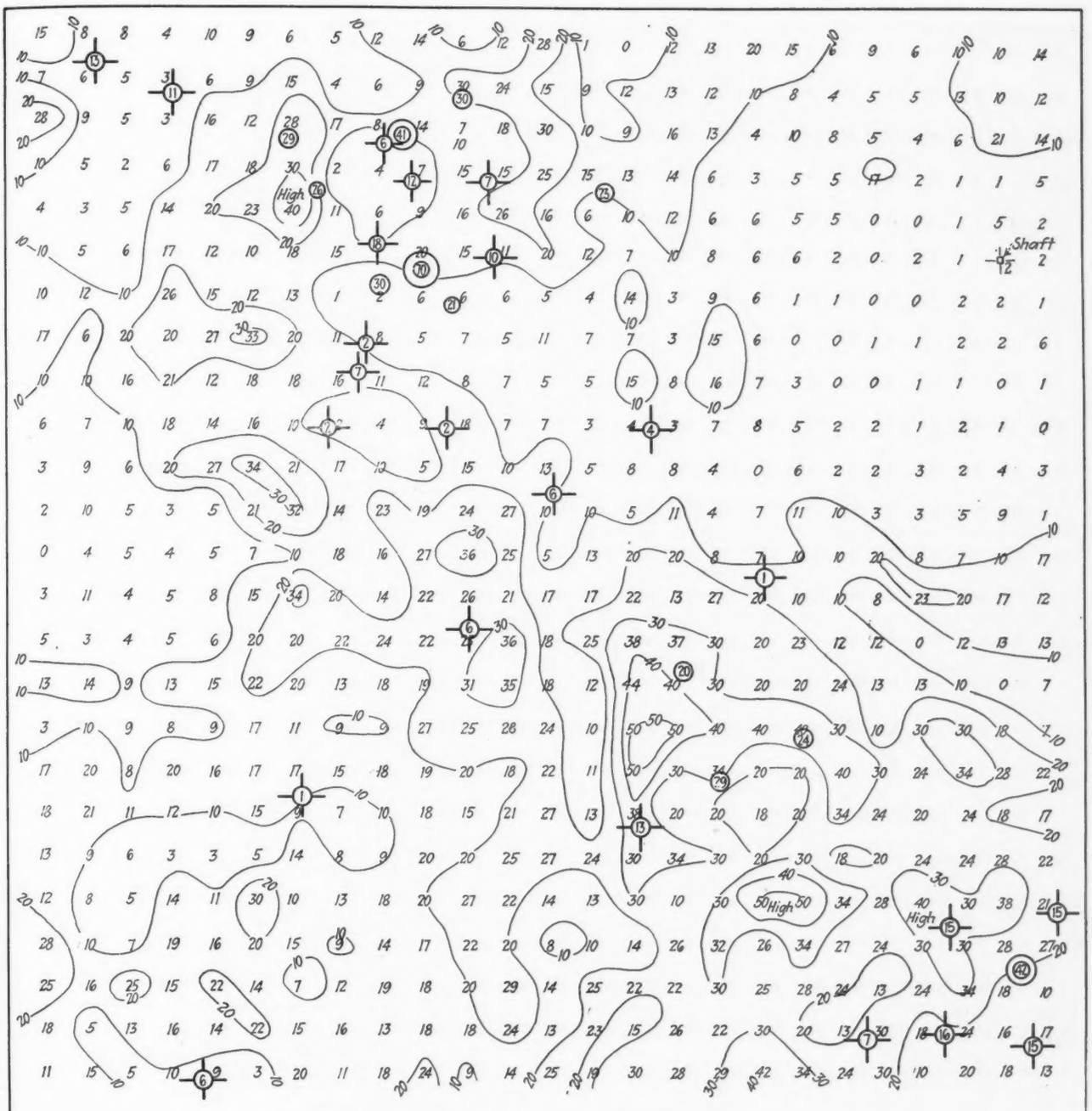
These results justified a continuation of the study on larger collections of specimens to test more rigidly the new criteria. Accordingly, in the spring of 1922, I made a special study of croppings at the mine. To further the plan an official of the company designated an area half a mile square, on part of which, he informed me, ore had been developed, whereas in other parts drilling had found no ore; but, at my request, he gave no intimation of the location of either the favorable or unfavorable spots. After preliminary tests as to the number of specimens required for a representative sample, the following plan was adopted:

Samples were taken at the intersection of coordinates 100 ft. apart, each sample consisting of ten specimens from 1 to 2 in. in diameter, and broken to show a fresh surface for inspection. The specimens constituting a sample were taken within a radius of 8 or 10 ft. and represented the cropping, whether float or rock in place. The residual float covering in this area is thin and has undergone only slight lateral transportation. The specimens were examined under the binocular microscope and were rated in terms of their indicated pre-oxidation copper metallization on a scale of 10. The sum of the ratings of the ten specimens constituting a sample was taken as the rating of the sample as a whole, and this figure was recorded on a map at the location of the sample. When the area was covered in this way the numbers on the map were found to range from zero to 50. Inspection revealed the higher numbers segregated in spots and somewhat removed from considerable areas of lower ratings. Lines were drawn through stations of equal ratings[2] from 10 to 50 at intervals of 10, as shown on the map, Fig. 4.

## Definite Relations Between Drill Records and Map

The map shows four "high" spots, where the ratings are 40 or higher, ranging northwesterly across the map, and also larger areas of comparatively low ratings running northeasterly. The confidence and speed with which I could rate the specimens, the consistency of repeated ratings with the identity of the samples concealed, and the orderly gradation of ratings from low areas to high—all suggested that the "highs" might

[2]For convenience these lines may be called isocuprics (equal copper) and the map, a cuprometric chart.




*Cuprometric Chart of an Area Half a Mile Square*

Numbers on co-ordinates are ratings of croppings in indicated copper metallization.

Lines of equal copper metallization show four highs (ratings 40 or higher) near three of which commercial orebodies have been developed, the fourth not yet explored.

Numbers enclosed (6) are ratings of orebodies cut at these points by churn drill (1/10 thickness of ore in feet X assay value in copper). Bodies rated lower than 20 are not commercial. They are indicated -(6)- ; commercial bodies are indicated (80), the area of the circle proportional to the ratings of orebody.

The best development in each case is 200 to 300 ft. southeast of the adjacent "high." The structure dips to the southeast. The capping is about 400 ft. thick.

Approximate scale 0 400 Ft.

Distances paced.

*Fig. 4—Map made by author following a special study of croppings at the mine, in the spring of 1922*

represent spots of most intense mineralization and consequently might bear a certain relation to orebodies. Later, when the map was compared with the map of the company on which the orebodies were shown, a very definite relation was revealed. The transfer of the drill records to the map showed that three of the "highs" are near developed orebodies, and that the vicinity of the fourth remains to be explored. The best development in each case was found to be from 200 to 300 ft. southeast of the adjacent "high." This uniform relation between the orebodies and their adjacent "highs" is explained by the fact, which I learned after the work was done, that the dip of the structure and of the orebodies is to the southeast. The oxidized capping at this mine is about 400 ft. thick.

A further examination of the map shows not only that the orebodies lie near 'highs," but also that the drilling and shaft sinking in the large "low" spots remote from the "highs" (more than half the development in the area) found no ore.

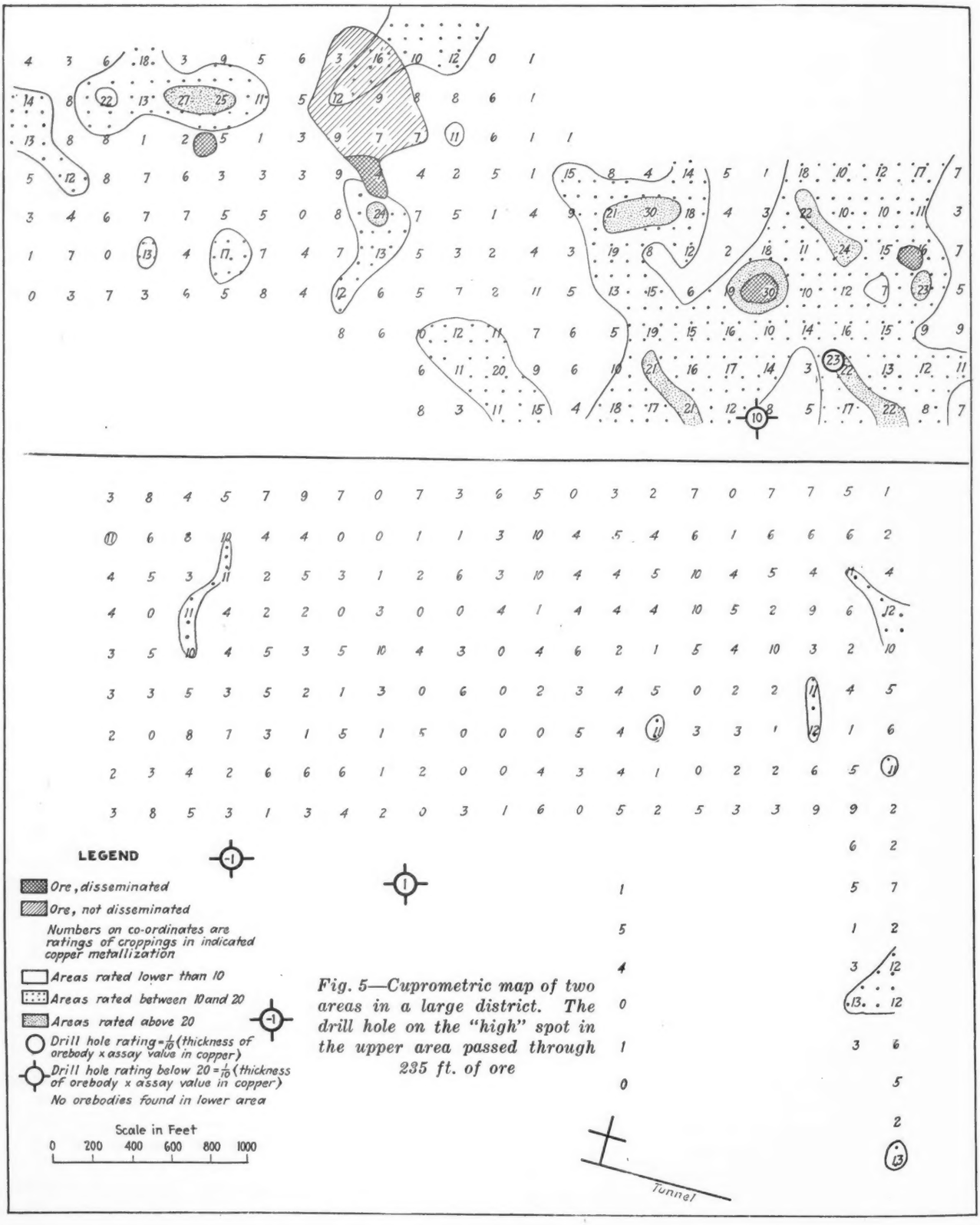

LEGEND
Ore, disseminated
Ore, not disseminated
Numbers on co-ordinates are ratings of croppings in indicated copper metallization
Areas rated lower than 10
Areas rated between 10 and 20
Areas rated above 20
Drill hole rating = 1/10 (thickness of orebody x assay value in copper)
Drill hole rating below 20 = 1/10 (thickness of orebody x assay value in copper)
No orebodies found in lower area
Scale in Feet
0 200 400 600 800 1000
Tunnel

*Fig. 5—Cuprometric map of two areas in a large district. The drill hole on the "high" spot in the upper area passed through 235 ft. of ore*

The fact that three of the four "highs" bear a definite proved relation to the only three known orebodies in the area is significant and justifies exploration for the indicated fourth body. It should be kept in mind, however, that the method in its present stage of development appears only to indicate the point at which exploration should begin and the direction it should take in case the first attempt does not succeed. The possibility of missing the ore the first trial and finding it the second or third is shown by the irregular, spotty occurrence of the ore on the north side of the area. It should also be remembered that though the criteria have been developed and applied with success in one district to distinguish ore-bearing from non-ore-bearing

ground, it cannot be assumed that the same criteria are universally applicable and will serve without modification in other districts. It is well known that croppings in different districts bear certain resemblance to one another in chemical and physical properties, but the value of these properties as criteria in the several districts remains to be determined.

This paper, essentially as given above, was prepared during the summer of 1922, and was read by many geologists and engineers. Publication was deferred until the method could be further tested in other districts. At intervals since that time I have continued the work in southwestern United States and in Mexico, and have examined up to the present time between four and five square miles of mineralized ground, distributed among five large disseminated copper districts. These studies involved the examination of more than 43,000 specimens and resulted in identifying the croppings of fourteen distinct orebodies. Typical areas in the districts examined are shown on the accompanying maps.

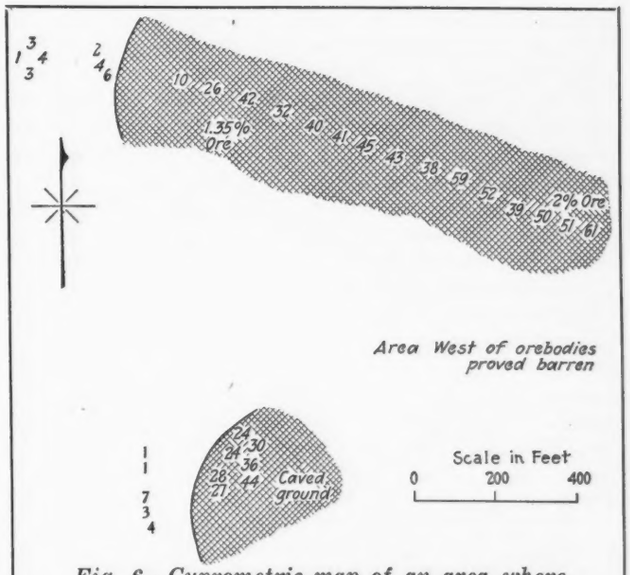



*Fig. 6—Cuprometric map of an area where the orebodies are large*

## Principles Upon Which Method Depends

The uniform agreement between predictions, based on a study of croppings and conditions underground in so many districts, justifies publication at this time. To make clear the possibilities of the method, as well as its limitations, I will state briefly the principles upon which it depends. In succeeding papers further details of operation will be given.

The percentage of disseminated primary (hypogene) copper introduced into the rock is usually so small—a few tenths of 1 per cent—that a great vertical thickness of primarily mineralized ground is required to yield the secondary (supergene) copper now in the deposit—a much greater vertical thickness than exists at present between the land surface and the orebody; therefore much of the supergene copper in the deposit was extracted from rock, now eroded away, which at a former period lay above the present surface.

As the land surface was gradually lowered by erosion, the sulphides were oxidized and the copper was dissolved, carried down, and redeposited, the processes of oxidation, solution, and deposition being repeated and carried on *pari passu* with the lowering of the ground-water level. Obviously, the supergene copper which had its origin above the present land surface passed through the present surface rocks on its halting descent and paused as chalcocite while these rocks were at or near the ground-water level. To distinguish between the oxidized and weathered products of disseminated pyrite on the one hand and the same disseminated sulphide largely replaced by chalcocite on the other, is to identify the thoroughfares by which the copper descended to its present position. The intersection of the land surface by such a thoroughfare may be vertically above the orebody, or it may be obliquely above it, depending upon the direction of easiest flow of descending solutions, and this depends upon the direction taken by zones of fracturing or fissuring or porosity of the rock, and cannot always be determined by a surface examination. If the orebodies are large, as those shown in Figs. 6, 7, and 8, the first drill hole should find ore; if they are small, as those shown in Figs. 4 and 5, more than one hole

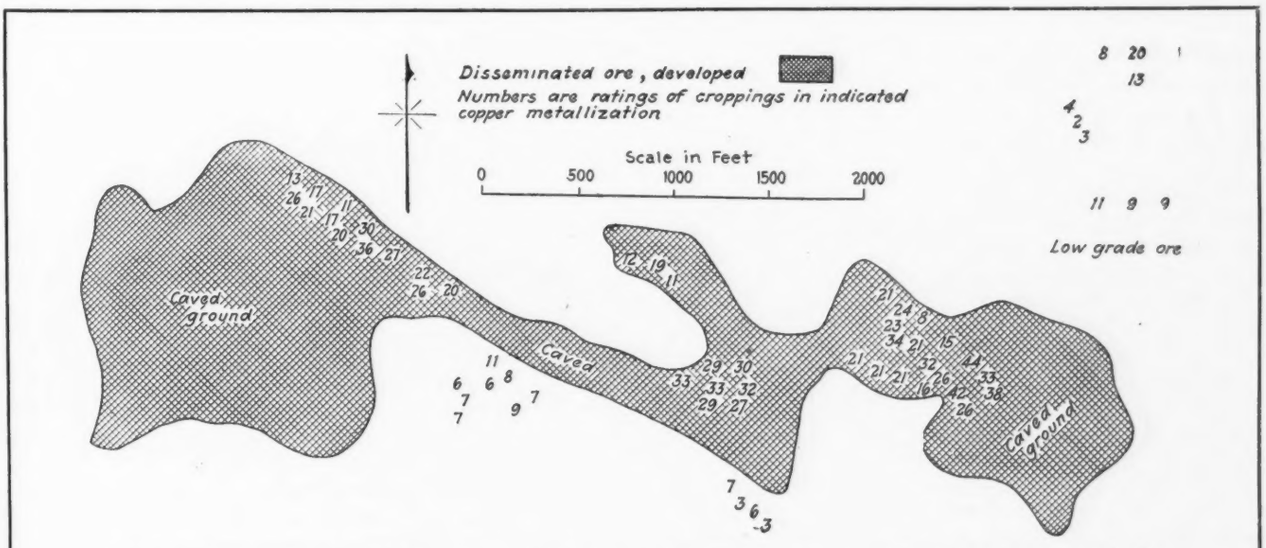



*Fig. 7—Cuprometric map showing results obtained where area mapped contains a large orebody*

may have to be drilled before the orebody is found, but the radius within which the search is justified is definitely limited.

Though the conditions described above may be considered normal, one must always be prepared for the unusual; for example, an old surface of erosion—a peneplain—may have weathered for a long period with so little erosion that the rock may have become thoroughly decomposed and permeated with iron stain to such an extent that the distinguishing characteristics may be largely destroyed. A part of the orebody on the north side of the areas mapped in Fig. 4 has such a cropping.

Another unusual case is that of a district in which supergene copper having accumulated at a shallow depth was subjected to an important uplift with a corresponding lowering of the ground-water level. After the uplift the copper was dissolved and dropped to the new ore and in obviating exploration of barren ground. It has been successfully used in identifying the croppings of many orebodies previously discovered, even under unusual conditions. It is important, however, as shown by the examples given above, that the operator have recourse to every aid known to all branches of geology as well as to other sciences, especially chemistry and physics.

It should be kept in mind that by this method accuracy increases with the number of specimens constituting a sample and with the number of samples taken in a given area. I learned by trial that repeated ratings of the samples from a given area were more consistent than the ratings of samples taken in duplicate. It is important to remember that the identity of a sample is never known until after it has been rated and the rating recorded, the tag carrying the identification number being folded in such a manner as to conceal the number.

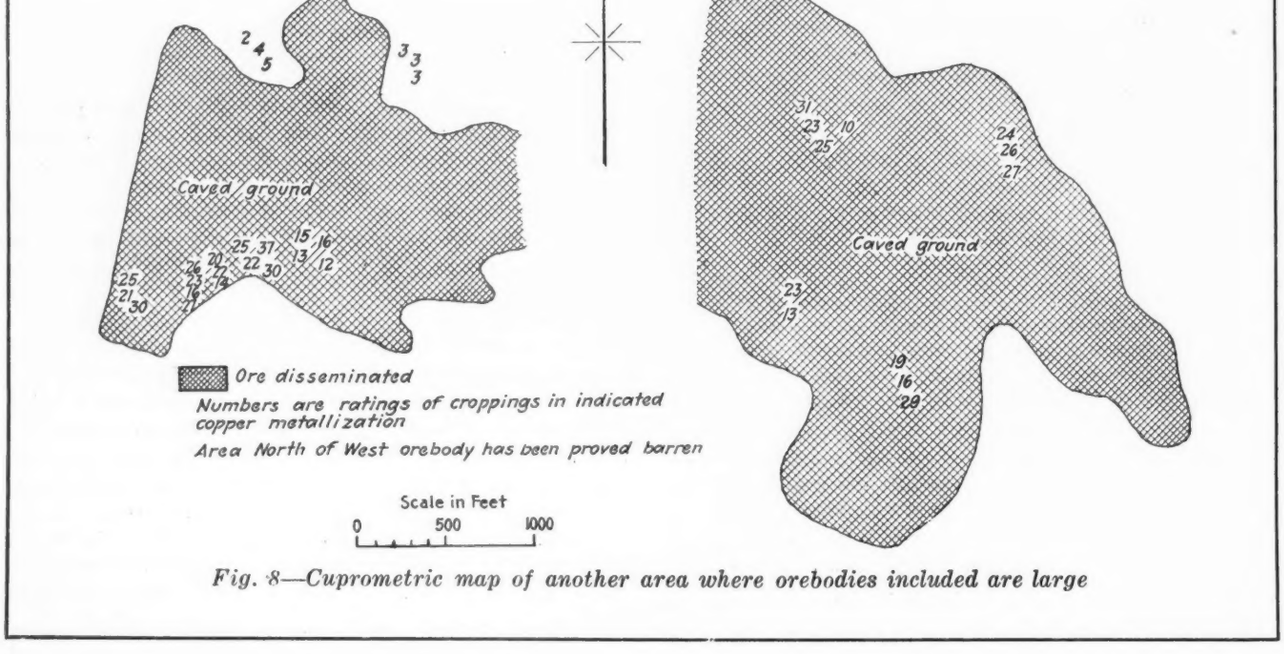



*Fig. 8—Cuprometric map of another area where orebodies included are large*

water level. Erosion has lowered the surface to the region between the bottom of the original position of the ore and the top of its present position, the cropping therefore showing little evidence of enrichment. One area has come within my experience which probably had such a history. There is an elevated peneplain, much dissected; deep water level; and a pyritic zone 100 to 200 ft. thick carrying a few tenths of 1 per cent of copper, between the oxidized zone and the orebody. The cropping has high-grade spots, enough to lead to the discovery of the ore but not co-extensive in all directions with the orebody.

Still another example of the unusual may be given. A drill hole was put down in a favorable porphyry cropping 800 ft. from a contact with limestone which showed on the surface. The drill unexpectedly soon passed into limestone, dispelling all hope of finding disseminated ore at that point, but revealing conditions favorable to high-grade ore in the vicinity of the avenues of escape downward of copper-bearing solutions.

The method has been successfully used in finding

It may be said in passing that mapping a single characteristic of a cropping—porosity, for example—is an interesting experiment in testing one's powers of observation and consistency of judgment; but as a means of discovering ore, it may be compared in the field of medicine to a prescription based upon a single symptom. Also, in the examination of cavities or voids in the capping to detect possible sources of copper, no advantage is gained by trying to distinguish between cavities of non-copper-bearing minerals, such as pyrite, feldspar, magnetite, tourmaline, or any others of similar form or similar cross-section. The problem is sufficiently complicated without the addition of non-essentials.

In studying this problem and in discussing it the importance cannot be overemphasized of keeping clearly in mind the distinction between the several types of copper deposits (native, contact-metamorphic, and disseminated), for each has its own particular type of cropping.

# Marketing of Fluorspar

*This Useful Mineral Is in Great Demand by the Steel Trade*

By Avery H. Reed
Mining Engineer, Marion, Ky.

FLUORSPAR is calcium fluoride, $CaF_2$, and one of the most important non-metallic minerals. It is raw material for iron and steel and aluminum smelting and the manufacturing of enameled ware, glazed tile and brick, opalescent glass and certain chemical products. About 80 per cent of the commercial mineral is prepared in gravel form and marketed to the steel industry for use in the manufacture of steel. Under normal business conditions 125,000 to 150,000 tons annually is used for that purpose.

Foundries and also blast furnaces occasionally use lump fluorspar, and normally about 5 per cent of the total consumption, equivalent to about 8,000 to 10,000 tons annually, is so marketed.

Fluorspar in finely ground form is essential in the manufacture of opal glass and in the process of enameling iron and steel ware and glazing as practiced in the ceramic arts. It is used for manufacturing hydrofluoric acid, which is made on a large scale by the aluminum industry for direct use in the preparation of fluorides necessary for the reduction of aluminum. Hydrofluoric acid is made extensively and used directly by manufacturers of sodium fluoride, which is prepared commercially as a wood preservative and insecticide. Those uses consume normally about 25,000 tons annually, about 15 per cent of the total consumption. Other uses for fluorspar include metals refining, using ground and gravel; cement and carbon filament processing, using gravel, and chemical manufacturing, particularly cyanimid production, using gravel. Those branches together with some unspecified uses consume about 1,000 tons annually, equivalent to about one-half of 1 per cent of total consumption.

Of the iron and steel industries, the chief consuming centers are the eastern and mid-western section of the United States, especially Pittsburgh, Philadelphia, Buffalo, Cleveland, Youngstown, Gary, Chicago, Duluth, St. Louis, and Birmingham, with other small iron and steel centers in the western part of the United

*Loading conveyor at the Hillside mine, Illinois*

States and one district in Texas. Enameling of iron and steel is mainly carried on close to centers of iron and steel manufacture. Raw materials are prepared for the aluminum industry at East St. Louis, Ill. The principal glass factories of the United States are located in the states of Missouri, Illinois, Indiana, Ohio, Pennsylvania, West Virginia, and New Jersey. Ceramic centers are situated in Ohio, West Virginia, Pennsylvania, and New Jersey. Most of the chemical and other works using fluorspar are located in the eastern and mid-eastern section of the United States, although a little fluorspar for such consumption is used in the West.

The chief marketing points for fluorspar are, in order of importance, Cincinnati, Pittsburgh, Philadelphia,

*Loading gondolas with fluorspar at Marion, Ky.*

New York, Cleveland, Chicago, St. Louis, Muncie, Ind., and Marion, Ky.

Of the three physical forms of fluorspar of commerce, lump, gravel, and ground, two grades of each form are marketed. Lump and gravel are sold as metallurgical or fluxing grades, and acid grades; ground is sold as glass-enamel-ceramic grade, and acid grade. Lump spar of either grade should not be too large, and small lump, not exceeding 6 in. in diameter, is preferred by the trade. Specifications for physical form of metallurgical lump spar demand a minimum content of gravel fluorspar, as fines, in any carload, say not exceeding one ton. Metallurgical gravel spar should not be too fine, and coarse gravel with minimum content of fluorspar sand, as fines, is more acceptable to the trade. Size specifications for metallurgical gravel spar demand that it shall pass through a 1-in. ring.

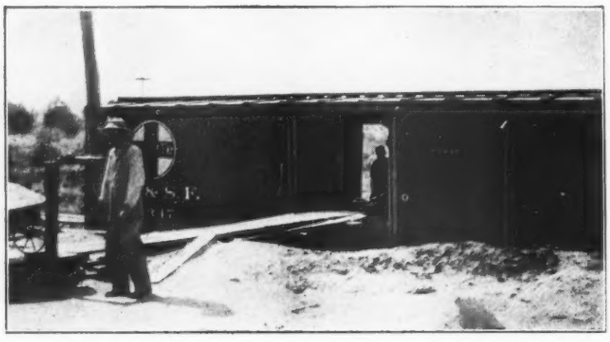
The market specifications for standard fluorspar in any form are mainly chemical, and governed by analysis. Guaranteed analysis for standard metallurgical or fluxing grade spar, lump or gravel, is minimum of 85 per cent calcium fluoride, and maximum of 5 per cent silica. Merchantable grade acid-spar, lump, gravel and ground, varies somewhat with different users. Not exceeding 2 per cent silica and under 97 per cent calcium fluoride are the limits. Part of the trade insists on a guaranteed minimum of 98 per cent calcium fluoride and maximum of 1 per cent silica, though some consumers are satisfied with a guaranteed minimum of 97 per cent calcium fluoride and maximum of 2 per cent silica. Glass-enamel-ceramic grade ground fluorspar specifications are flexible, the users of that class of spar particularly demanding fine grinding, preferably 150 to 200 mesh, and thorough washing free from alumina; also freedom from contamination of metallic ores and barytes. Analyses for glass-enamel-ceramic spar vary from 90 to 95 per cent calcium fluoride, 2 to 5 per cent silica, and 2 to 8 per cent calcium carbonate.

The usual impurities in fluorspar are silica and cal-

cium carbonate, which are penalized, as a rule. Minor impurities in fluorspar are ores of lead and zinc, generally the sulphides, and pyrites and barytes, all of which are objectionable, and sometimes penalized.

No premiums are allowed on fluorspar shipments, but there is a penalty for inferior material. Trade specifications demand that for each point of calcium fluoride less than 85 per cent there shall be deducted 1/85th of the delivered cost, and for each point of silica over 5 per cent there shall be deducted 1/40th of the delivered cost.

Fluorspar is generally sold in bulk, and in carloads, and only occasionally is it shipped in less than car lots, in packages, bags, or barrels. Ground fluorspar is shipped about equally in carloads, either bulk or in



*Weighing and loading fluorspar with wheelbarrows in box cars*

packages, some customers preferring it one way and some the other.

There is no difficulty in sampling ground fluorspar, as it is so thoroughly mixed by grinding that a grab sample is uniform. Gravel fluorspar, after loading in cars, is somewhat difficult to sample satisfactorily, because the material does not lend itself well to the best method of sampling by driving pipe at random through it in cars; and it is generally sampled by grabbing all over the surface of car loads, which practice of sampling does not return a fair average of entire car contents and only includes the surface, which, as a rule, according to the analogy of "big apples coming to the top," gives the largest particles of gravel spar and the poorest quality in any car shipments; therefore such practice of sampling is unrepresentative and unfair. Lump fluorspar, especially metallurgical grade, is quite difficult to sample correctly; and the custom is to break off small pieces from different random lumps over the surface of car shipments, for a sample, which practice does not give a representative sample.

The necessity of sampling and analyzing before unloading car shipments makes the matter of sampling difficult. It would be best to require the shippers to take correct average samples, in the act of loading cars, of gravel and lump spar, and mail them to customers at the time of shipping cars. Some of the larger producers of fluorspar employ chemists at the mines and are prepared, on request, to furnish analyses of average daily mill run loading, stock shipments, or of each separate car shipment if necessary. Nevertheless, buyers generally demand the right to govern settlement by their own sampling and analyses, which custom is not always satisfactory to shippers.

Box cars generally have been the carriers of fluorspar in the past, and are still used extensively. Of course ground fluorspar, in packages or in bulk, will always have to be loaded and shipped in box cars. Recently, since the largest mines have made direct railroad connection, gondola cars have come to be used freely, for shipping fluorspar in gravel and lump form, and, because of easiness in loading by crane and clamshell and of readiness in unloading at destination by the same means, or having the privilege of discharging hopper bottoms over trestle work in the stock houses of users, no doubt standard practice of the future will be to load and ship in gondola cars by preference.

Fluorspar is bought and sold by the net ton of 2,000 lb. Present published tariffs specify minimum carload at 40,000 lb., and maximum at capacity of cars.

In LCL shipments of fluorspar, packages are required by the railroads. Light cooperage barrels are used for lump, gravel or ground, and weigh from 300 to 500 lb. filled. Bags may be used for gravel and ground fluorspar, and the practice is to fill them to weigh 100 to 125 lb.

Railway track scale weights derived at mines or near point of shipment generally are applied on invoices and accepted in settlements. Weight of loaded car is taken for gross, and the stenciled weight on cars is taken for tare. However, a few buyers insist on settlement based upon destination weights on their own plant scales, weighing the load gross, unloading and weighing the empty car for tare. In controversies arising, the buyer contends that the stenciled weight on cars is not always correct, and that gravel spar, as shipped in box cars, has considerable moisture in it when shipped, which will drain out before the material arrives at its destination. The shipper contends that on an average the stenciled weight on cars is fair, being as often favorable to buyer as to shipper, and that any shrinkage in weight due to probable moisture, in gravel spar shipped in box cars, is fully compensated by the probable quantity of spar usually left in cars on account of failure to unload the spar completely and sweep out the cars at destination. As to shipments in gondola cars, subject to variable weather conditions in transit, there could not be any tenable claim for moisture by the buyer. There is a probability of shrinkage in transit in any form of spar shipped in gondola cars.

No established custom exists of insurance against loss of fluorspar in transit. Whenever a controversy arises between buyers and shippers over discrepancy in weights obtained at destination, the outcome generally is that the buyer will only settle for destination weights, and throws the burden on the shipper of making a claim against the carriers for shortage, which practice is hardly equitable.

Value is computed according to guaranteed analysis of the product bought and sold, with deductions for penalties as specified, if any. Settlement is usually thirty days net, with the customary discount for settlement in ten days.

The intending producer should be familiar with certain marketing problems. Most of the fluorspar of commerce is handled through established brokers, and consequently little fluorspar is bought directly by the consumers from the producers. These brokers have a clientele that they are proud of and with whom, as customers, they have great prestige. Under normal business conditions, fluorspar is bought and sold under contract, some definite tonnage for periodic delivery over a limited time, generally the consumers' estimated requirements for one year. The established brokers who place contracts with the consumers generally handle, in their line of sales commodities, related raw mate-

rial products. One related raw material product may influence the purchase of another. Therefore it is difficult for a producer to sell fluorspar direct to the consumer, in indiscriminate car lots, and without covering a definite tonnage either for immediate lot shipment or for guaranteed periodic delivery over a definite interval of time.

Furthermore, established brokers of fluorspar and related products, and the principal producers of fluorspar, usually have close contracts with each other, whereby the broker agrees to handle and the large producer agrees to supply, such fluorspar as is produced, exclusively. It is no longer general practice, as it once was, in the principal fluorspar district of Kentucky-Illinois, for the larger producers, with their exclusive contracts with the most influential brokers, to buy for resale the desultory output of smaller producers of spar.

The domestic source of supply of fluorspar in the United States is principally the Kentucky-Illinois fluorspar district, which is comprised of a few contiguous counties in western Kentucky and southern Illinois. Other minor sources of supply are in restricted areas elsewhere, as in eastern Kentucky, Tennessee, New Hampshire, and several of the western states—namely, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, and California.

According to R. B. Ladoo, our known reserves are low, and, unless new deposits are found, fluorspar will be very scarce and expensive within a few years. The development of possible substitutes is being considered. Most of the deposits of the Far Western states are small.

From 1880, the infancy of the fluorspar industry, until 1905, western Kentucky was the principal source of supply. Afterward, excepting the year 1921, the output from the Illinois operations exceeded that from the western Kentucky field.

For many years during the early history of the fluorspar industry, in the principal district of Kentucky-Illinois, the mineral was attained from leaseholds, and mined almost entirely by contract system at so much per ton of clean merchantable product delivered at railroad or river point of shipment.

**Average Annual Prices, Domestic Fluorspar Sold[1]**

Per Net Ton, f. o. b. Mines

| Year | Gravel | Lump | Ground |
|---|---|---|---|
| 1913 | $5.87 | $6.88 | $12.31 |
| 1914 | 5.21 | 8.45 | 11.78 |
| 1915 | 4.89 | 7.51 | 10.80 |
| 1916 | 5.34 | 7.94 | 12.38 |
| 1917 | 9.61 | 13.68 | 17.59 |
| 1918 | 20.05 | 24.12 | 31.21 |
| 1919 | 23.80 | 30.38 | 43.02 |
| 1920 | 23.24 | 29.85 | 43.32 |
| 1921 | 16.11 | 21.39 | 40.00 |
| 1922 | 16.36 | 18.56 | 36.42 |

[1] Statistical Reports of U. S. Geological Survey.

The conditions have changed, and today the production of fluorspar is attained from selective properties that are owned in title, and by systematic mining, in extensive and deep underground workings, with employment of skilled labor. Large investments of capital have been made in acquiring meritorious fluorspar properties and developing large mines and equipping them adequately; therefore with necessitated capital earnings, and increased expenses of systematic, extensive, and deep mining operations, including the handling of large quantities of mine water, and required ore dressing, the cost of production of fluorspar has increased.

Nevertheless, apparently every effort has been exerted by the consumers of fluorspar to break the established post-war prices of the commodity, with the producers trying to uphold their prerogatives, until the market has become precarious.

The producers claim that established current post-war prices are fair and reasonable, based upon investments, amortization, depletion, scarcity, high cost of production, and legitimate earnings. The consumers seem to think current prices for domestic spar are exorbitant.

The present status is that the principal producers are selling what they can at current prices, and conserving their mineral resources, hoping to be able to continue to carry on in legitimate business. On the other hand, several large consumers, directly or indirectly, have lately purchased fluorspar properties in western Kentucky and seemingly propose to produce their own requirements of the mineral.

The Lafayette Mining Co., organized as a subsidiary of the United States Steel Corporation, has acquired large fluorspar properties on the Tabb vein near Mexico, Ky.; the American Rolling Mill Co. is operating a leasehold near Sheridan, Ky.; interlocking stockholders and officers of Brier Hill Steel Co. and the Youngstown Sheet & Tube Co. control the Ohio-Kentucky Fluorspar Corporation, operating near Smithland, Ky.; stockholders and officers of the United Alloy Steel Corporation control the United Mining Co., operating near Lola, Ky.; and the Aluminum Ore Co. owns the Haffaw mine, Mexico, Ky., and the Memphis mines near Marion, Ky.

*Crane used for car loading at Fairview, Ill.*

Metallurgical fluorspar is prepared for market usually in wet method dressing plants. Lump is generally hand-sorted from picking belts, but sometimes it is obtained merchantable as oversize rejections in screening practice. Gravel is the mill concentrate resulting from crushing, washing, jigging, and tabling. However, some metallurgical grade spar is still prepared for market by the processes in vogue in the early period of production of the mineral—that is by cobbing the lump and log-washing and hand-picking the gravel.

Acid fluorspar is prepared for market in two ways at the present time: (1) Hand-sorting on picking belts in concentrating plants of run-of-mine fluorspar. Such preparation of acid spar is standard practice for the three large Illinois mines. (2) Mechanically, by preliminary log-washing, crushing, and jigging in many-celled jiggs that effect a little concentration but mainly augment thorough washing by scrubbing action and decantation. Such preparation of acid spar is the practice for treating surface-mined gravel fluorspar, and is standard for small mines in Kentucky and Illinois.

The first method of preparation of acid spar affords nut and lump acid spar, and the second method affords gravel form of acid spar. Both forms are sold as prepared, or else both forms may be ground and sold as ground acid spar.

Optical fluorspar is perfectly transparent and preferably colorless, although a slightly yellowish tint is acceptable. It is used for making certain lenses of optical instruments, and is obtained by careful hand selection[2]:

"For optical use a specimen of fluorite must contain a portion at least one-fourth of an inch in diameter, free from flaws, and colorless or nearly so. Crystals, or pieces bounded more or less completely by plane surfaces, are more likely to qualify than irregular masses. As the surfaces of most crystals are dull, a corner of such a specimen should be broken off with a sharp blow so as to expose the interior. In doing this, it is desirable to rest the specimen on a wooden base and break off the corner along an incipient cleavage plane by means of a knife blade or chisel; such planes are usually present and may be located by moistening the specimen with kerosene. If the specimen looks promising, it is better to proceed no further, as fluorite is fragile and a misdirected blow will fill a clear piece with a network of fractures. A peculiarity of fluorite of optical quality is its conchoidal (irregularly curved) fracture and the absence of a strong tendency to break into pieces bounded by smooth planes in the fashion of the ordinary mineral.

"The value of optical fluorite and the demand for it cannot be expressed in definite figures. On the one hand, the demand will increase if optical fluorite can be produced at a figure sufficiently reasonable to warrant an enlarged utilization; whereas, on the other hand, an inflated price will destroy the opportunity for increased use. It must be remarked also that only a small portion, say 4 to 8 per cent on the average, of material classed as optical fluorite actually passes into the make-up of a lens-system; much of the mass must be destroyed or discarded during the manufacture. In other words, twenty-five pounds of good looking clear fluorite may produce no more than one single pound of finished lenses. Hence the value of the finished product comes only in part from the value of the raw fluorite entering into it; much of its value is introduced by the skillful work essential to its manufacture. These statements are made to prevent the assumption that crude optical fluorite is of gem value. In order to make the matter more specific, fluorite qualifying as optical in quality is worth a dollar or more a pound, while particularly large and fine specimens have an individual value of $10 and more apiece. These figures are rough approximations only, designed to give prospective producers a general idea of what their product may be expected to be worth."

The statistics in the table show the relative percentage of consumption of fluorspar by the various industries using it.

Native cryolite, produced in Greenland, sometimes affects the acid and glass-enamel-ceramic grade fluorspar markets. Whenever cryolite can be obtained cheaply and plentifully in the United States it is often used by the aluminum industry instead of artificially prepared cryolite that the Aluminum Ore Co. ordinarily manufactures for that portion of the electrolyte functioning in aluminum reduction. In the manufacture of opaque white glass and in the process of enameling ironware, native cryolite is frequently used instead of fluorspar, depending on the relative prices.

The different countries in the world producing fluorspar are the United States, England, Saxony, Bavaria, Czechoslovakia, Italy, Spain, France, Belgium, Norway, Transvaal, Australia, China, Argentina, Mexico and Canada. Statistics of production are given in "Mineral Resources of the United States," published annually by the U. S. Geological Survey.

England produces between 20,000 and 60,000 tons yearly. Statistics have not yet been made available for the production of several of the foreign countries. Germany, it has been estimated, made an average pre-war production of about 8,000 tons annually; but undoubtedly the production of fluorspar in Germany greatly increased during the World War. Estimated average annual production before the war of former Austria-Hungary has been placed at about 20,000 tons.

About the year 1910 increased demand for fluorspar in the United States had greatly exceeded the domestic production, and imports of the mineral then attained first high proportions, the importation of fluorspar for that year amounting to 42,488 tons, as against a domestic production of 69,427 tons. As a result of such conditions, there was a reawakening of domestic producers and extensive developments and improvements were made in the largest American operations, particularly at Rosiclaire and Fairview mines in Illinois, so as to meet the demands and increase the domestic production. Hence followed continued decrease in importations annually until 1916, well into the period of the World War, which event made again the strongest demands possible on fluorspar production, thus increasing the domestic output beyond precedent.

The war period brought on relatively high prices for fluorspar, compared with pre-war prices, and it has been disappointing to consumers that the prices have not come back to approximately those prevailing before the war. By 1922 consumers had become hesitant about buying domestic fluorspar at current prices, and accordingly imports increased and reached the quantity of 33,108 tons, an amount next highest, at the time, to the maximum quantity imported previously.

Statistics compiled and just made available by the Bureau of Foreign and Domestic Commerce show that imports for 1923 amounted to 42,226 net tons, 22,862 from England and 10,380 from British South Africa.

In the past it has been a fact that most of the imported spar has been metallurgical grade only, and usually much inferior in quality to domestic metallurgical grade spar; but imported metallurgical grade fluorspar during the last three years has been much better in quality than formerly. Now, also, there has begun to be imported high-grade fluorspar, suitable for acid manufacture, especially from Germany and British South Africa, from which latter country the Aluminum Ore Co. is reported to have received, in 1923, by the ports of Mobile and New Orleans, several thousand tons of acid grade fluorspar.

Ordinarily, imported fluxing-grade fluorspar has affected only near-by seaboard points of consumption, as Sparrows Point, Md., Coatesville and Steelton, Pa., particularly. But in the last year foreign spar has been moved as far west as the Youngstown district in Ohio.

The present import duty on fluorspar is $5.60 a long ton, equivalent to $5 net ton.

[2]"Optical Fluorite in Southern Illinois," by J. E. Pogue. Illinois State Geological Survey, Bulletin No. 38.

**Fluorspar Shipped in 1921 and 1922, by Uses[3]**

| Use | 1921 Percentage | 1921 Short Tons | 1921 Value Total | 1921 Value Average | 1922 Percentage | 1922 Short Tons | 1922 Value Total | 1922 Value Average |
|---|---|---|---|---|---|---|---|---|
| Steel | 73.09 | 25,553 | $407,230 | $15.94 | 86.44 | 122,403 | $1,987,596 | $16.24 |
| Foundry | 4.35 | 1,521 | 30,632 | 20.14 | 2.12 | 2,998 | 57,011 | 19.02 |
| Glass-enamel-ceramic | 10.02 | 5,599 | 224,137 | 40.03 | 6.29 | 8,904 | 323,116 | 36.29 |
| Hydrofluoric acid (including fluorspar used in manufacture of aluminum) | 5.24 | 1,833 | 52,455 | 28.62 | 3.38 | 4,782 | 118,648 | 24.81 |
| Miscellaneous | 1.30 | 454 | 9,440 | 21.23 | .15 | 213 | 3,838 | 18.02 |
| | 100.00 | 34,960 | 724,094 | 20.71 | 98.38 | 139,300 | 2,490,199 | 17.88 |
| Exported to Canada | | | | | 1.62 | 2,296 | 40,966 | 17.84 |
| | 100.00 | 34,960 | 724,094 | 20.71 | 100.00 | 14,596 | 2,531,165 | 17.88 |

[3]Statistical reports of U. S. Geological Survey.

# DISCUSSION

*"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.*

## Tariff Protection for Copper

THE EDITOR:

Sir—I have read with great interest your comment in your issue of Feb. 16, 1924, upon the proposition for a tariff on copper, and I note with interest your reference to the result of tariff protection on lead and zinc. I am not familiar with the market on lead and zinc, but the gist of your argument appears to be that the price of lead in the United States is enhanced by reason of an import duty, as American production is barely large enough to cover domestic requirements.

In your same issue on page 311 you give the exports in December, 1922, of lead from domestic ores at 2,021,367 lb. and from foreign ores 7,984,381 lb. The average price of lead in New York in December, 1922, was 7.167c., as against 4.047c. in 1913. Did not the tariff have something to do with this price? What effect would the dumping of the eight million pounds of foreign lead have had upon the price in December, 1922? Cannot the American producer of lead control the selling price of his product because of the exclusion of foreign lead?

You state in your editorial that "duty on zinc slabs is 1¾c. per pound, and in 1923 it was about as useful as a book on evolution is to William Jennings Bryan." Do the producers of zinc ask that the tariff on zinc be removed because they have not profited by it? Is not the selling price of zinc in 1923 higher than it was in the pre-war period? Does not the American producer of zinc protected by a tariff of 1¾c. a pound at least fix the selling price of his product? If he overproduces and kills his market who is to blame?

The average price of copper in 1913 was 15.269c. and in 1922 was 13.382c. The American producer of copper did not fix the price of copper in 1913, when perhaps 50 per cent of the production of American mines was exported, nor did the producer fix the selling price in 1922 or 1923, when, during the latter year, the production of copper from American mines barely exceeded the consumption by American buyers.

The United States cannot produce enough copper to supply the market of the United States and sell it at the average price of 1923. For proof of this I will refer you to the reports of several copper-mining companies of the United States for the year 1923. The producer of copper in the United States does not make the selling price of copper in the United States, nor can he make the selling price until the copper produced by foreign mines is excluded from the American market.

It is not true in any line of industry which is protected from foreign competition that that industry will sacrifice its home market on account of a small surplus production; those in other industries protect their home market by selling their surplus in foreign markets even at a reduced price. There is no reason why the copper producer should not be permitted to do the same. The surplus that ordinarily would be shipped to Europe and other markets of the world would as certainly be shipped under a tariff as it is at the present time and the producer of copper in the United States would have a living price. Otherwise, there would be an enforced shutdown of the very high-cost producers, which would mean that production from the mines in the United States was less than consumption. A voluntary curtailment of production of the mines of the United States will not help the present situation as long as one foreign producer determines that he will sell copper from day to day regardless of the price and of the last quotation.

The tariff is not a panacea. Good business judgment in the marketing of copper is an essential, and a voluntary curtailment of production by the lower-cost producers may be necessary to insure stable prices; but such curtailment is useless when the foreign mine can increase its production to replace such curtailment.

There is one thing certain: the tariff on lead has not injured the producer of lead. The tariff on zinc has not injured the producer of zinc, and a tariff on copper could not possibly make the situation of the copper mines of the United States worse than it is at the present time.

GORDON R. CAMPBELL,
President Calumet & Arizona Mining Co.
Calumet, Mich.

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THE EDITOR:

Sir—The object of tariff protection always is to encourage increased home production of the commodity protected. It never is the aim of the advocates of protection to put prices away up and make production highly profitable. What is desired is to prevent prices from going so low as to render production unprofitable, to give stability and permanence to the business of producing an article at home and supplying the domestic market.

Protection is a defense against those foreign competitors who sometimes are tempted to undertake to wreck home producers and drive them out of business by persistently underselling them, doing this for the purpose of retaining our market wholly for themselves.

If protection has the effect of increasing the production of the protected commodity within the country which imposes the tariff—as it invariably does—it naturally must result in more of that commodity being offered for sale in the markets of the world. Thus, while tariff protection is helping to support the price at a profitable level in the home market, by enlarging the total of the world's production it necessarily and unavoidably is exerting an influence to hold the price of the protected commodity down to a relatively lower level in all markets.

It would have this effect in the case under discussion. The mines of the world are producing at the rate of about 3,000,000,000 lb. of copper yearly. Almost exactly

the same amount of new copper is being consumed. If protection were to cause 100,000,000 lb. more to be produced annually in the United States, there then would be 3,100,000,000 lb. to be sold in the markets of the world, a development which could not fail to depress the price greatly in foreign markets. As this country's production then would be in excess of its consumptive requirements, the price of copper naturally would fall here also, for producers would sell at home as long as quotations remained higher than they were in the export market.

The copper-producing industry was built up in this country without tariff protection. More than half of the world's output is mined within the United States. Half of all the copper produced in other countries comes here to be refined. Mines that produce approximately three-quarters of the world's output are owned in and directed from the United States. This country dominates the world's copper-producing industry.

Until recently copper mining has been a thriving industry without protection. There actually has been a relative shortage of supplies the greater part of the time for more than a century. Selling prices usually have been 35 per cent to 60 per cent above the direct production costs. The reasons for low prices now are matters of common knowledge.

It must be appreciated that a tariff would not have prevented the billions of pounds of war copper from returning and insisting upon employment in peace industries. To impose a tariff now in this country would not hasten a reparations settlement, nor would it assist to bring about the European industrial stabilization, upon which a big increase in the consumption of copper is so largely dependent. It could not possibly help to speed up the increase in the consumption of copper either here or abroad. Yet this is the only thing that is needed—a larger consumptive demand.

The agitation for a tariff on copper will be of great educational value. It will direct attention anew to the vital importance of the home market. The experiences in recent years of the copper producers, the wheat farmers, and the cotton planters, all dependent largely on foreign markets, present a most interesting study.

When the war broke out the copper miners had to throw half of their labor out of employment and discontinue paying dividends. The cotton planters were obliged to beg philantropic individuals all over the country to "buy a bale." Immediately after the war ended the distress of the wheat farmers drove them to the madness of electing semi-Bolsheviks to Congress and to the despair of groveling and begging alms from the government.

Cotton sold for half the cost of production. Thousands of planters lost their all and came north to work for wages. Then, quite naturally, followed a crop shortage which sent prices so high that they became a severe burden on consumers everywhere, and also deprived tens of thousands of textile workers of employment.

Copper, with the cost of production 15 per cent to 20 per cent higher, has been selling 12 per cent to 17 per cent lower for three years past than before the war. The consumption of this metal has been 40 per cent to 75 per cent greater in this country than in pre-war times. It was the foreign demand that failed, as was the case with wheat and cotton.

Industries built up in the United States to supply home markets are generally prosperous and have been for some time. Those which increased their capacity greatly during the war, like steel, brass and the electrical equipment manufacturers—yes, even the zinc mines and smelters—are doing very well. It was only those who were striving for the foreign market plums, described so frequently and so alluringly by free-trade advocates, who fell and got bumped.

The outlook for an early and immense increase in the volume of copper consumption never was more assuring than it is now. Production, however, will expand very slowly until the price is up around 16c. to 18c., and not greatly even then. New copper mines of importance are not being developed now. There are not three good copper prospects in the whole world the exploitation of which has been financed. Operations which were started between 1903 and 1913, however, are now producing one-half of the world's output. Since 1913 not more than one or two developments of great prospective importance have been started. In view of this, what may we expect the copper demand and supply situation to be ten years hence?

Copper producers must wait for an increase in the consumptive demand. A protective tariff will do their industry no good whatever, as products of which there already is an excessive domestic output cannot be supported in price by protection. What appropriately has been called "the copper-tariff snowball" is likely to melt and disappear very soon in the warming glow of rising prices.

GEORGE L. WALKER.

New York.

## Gold and Trade

THE EDITOR:

Sir—Silver coins, except subsidiaries now used, do not bring particularly happy memories. In the San Francisco old times, on Steamer Day it was heavyweight practice collecting bills paid in $20 silver rolls and getting $1,000 of it, in a canvas bag, to the bank. The last gold coins I remember having, in this hemisphere, were some $20 pieces in Mexico City in 1904. That two men could not make a trade without employing a third to dig gold for a length of time, so that his wages equaled the value of the trade, has always seemed to me wasted energy.

The world is now supposed to be generally on a gold basis, and has been for many years; can its future continuance be expected, with the comparative paucity of gold and silver deposits, and the imaginable expansion of business in all corners of the world, and the increased population corresponding to the progress in the chemistry of agriculture? Taking figures of $35,000,000 gold and 14,000,000 oz. silver from your Jan. 19 Review Number as the increase in the world's output in 1923 over 1922, will this equal the growth of trade for the same period?

Some years hence, all Europe will have reached commercial adjustment and be working as people do after adversity and will call for gold and silver, that at the present ratio of these metals to the volume of commerce cannot be met.

I cannot think deeply enough to judge whether if the price per ounce of gold were changed from $20.67 to $41.34 or $10.335, all payable in gold, it would alter its purchasing value. When the gold miner says that the cost of labor and supplies does not permit of a profit, it might be suggested that too low-grade ore was being taken, his fate not being different from miners of other material.

J. B. HASTINGS.

Los Angeles, Calif.

# THE MINING NEWS

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## Summary of the Week

*THE American Bauxite Co. has completed a 4,000-ft. haulageway preparatory to mining bauxite at its mines in Arkansas by underground methods. Open-cut work is being displaced because of the prohibitive thickness of overburden.*

*Copper interests in Michigan have prepared a tariff bill which they will submit to all American copper producers in order to elicit their views on the subject.*

*President Obregon in a decree dated March 4 has established a new mine-tax law for Mexico.*

*Deeds have been recorded marking the formal completion of the transfer of the Davis-Daly property at Butte to the Anaconda company.*

*Extension of the scope of its training courses for young graduate engineers is announced by the United Verde Copper Co.*

*Development on the north end of the Tonopah Belmont company's 1,000-level workings has resulted in optioning a portion of the Mizpah Extension ground at Tonopah, Nev.*

*The Attorney General of the United States announces that he will appeal to the Supreme Court the question of refunds under the War Minerals Act on "purchase of property" claims.*

*The Union Mines Co. has started its sixty-ton concentrator in the Pioche district, in Nevada.*

*Reports from Queensland, Australia, indicate that the newly developed Cloncury lead deposits are unusually promising.*

*Regular production is being made by the White Pine Mining Co. from newly developed oreshoots at Goodsprings, Nev.*

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### Anaconda Gets Deeds to Davis-Daly Property at Butte

**Stockholders of Last-named Company Will get $4 Per Share Now; More Later—Ore to Washoe**

Deeds covering real estate, personal property, and mining rights of the Davis-Daly Copper Co. were given to Anaconda Copper Mining Co. and filed for record in Silver Bow County, Mont., on March 12. J. L. Bruce, as general manager, delivered the deeds to the legal department of the Anaconda company. According to revenue stamps on the documents involved, $2,500,000 was paid for real property and $500,000 for personal property and metal stocks. This action completes the transaction of transferring the total assets of the Davis-Daly company to Anaconda as a result of the compromise reached in the litigation over apex rights claimed by the two companies.

It is understood that Anaconda will operate the Colorado property, of Davis-Daly, through the Belmont shaft and will operate the Hibernia, located in the west end of the Butte district, through the Nettie shaft. These are the principal mines included in the Davis-Daly holdings. Davis-Daly ore has been concentrated and smelted by the East Butte Copper Co., but it is belived that within the next few days this arrangement will cease and ores will be treated at the Washoe plant of Anaconda company. Holders of Davis-Daly shares will receive first liquidation payment of $4 per share on all certificates presented for payment in Boston after March 17. The balance in liquidation will be paid in about two months.

### Colorado Fuel & Iron Co. Develops Iron and Fluorspar Mines

Following a meeting of the Board of Directors on March 12, the officers of the Colorado Fuel & Iron Co. announced that improvements to the Steel Works at Pueblo, Colo., costing approximately $3,000,000, had been authorized, and work would be started at once to make the plant one of the most modern and complete steel mills in the country.

For the last year or more the company has been developing its iron properties in Saguache County, Colo., and in development work has been shipping about 400 tons monthly, of a high-grade iron ore. A 6,000-ton shipment from reserves is now going forward to the Pueblo plant. The major part of the ore supply for the steel works has come in the past from the company's mines in Wyoming.

During the present year the company completed the purchase and took over the fluorspar properties formerly owned and operated by the American Fluorspar Co. at Wagon Wheel Gap. The mines will be operated by the company, and will furnish an ample supply of spar for the steel works.

### Court Refuses Damages to Tailing-Treating Lessees

**Blue Mound Mining Co. Installed Extra Tables in Slime Plant — Lessees Asked $250,000 on Contract**

A suit for $250,000 damages, asked by the Mineral Flotation Co. from the Blue Mound Mining Co., tried recently in the district court at Columbus, Kan., has been decided in favor of the defendant.

George and James Goodwin, of Baxter Springs, Kan., associated with others and operating as the Mineral Flotation Co., contracted with the Blue Mound company to construct a flotation plant to treat accumulated tailings at the Blue Mound mine, and tailings to be accumulated in future. This contract was entered into in 1917. The flotation company erected the plant and operated it until June, 1920, when it was destroyed by fire. It was not rebuilt, and the explanation, as offered by the plaintiff company in the trial, was because the Bule Mound company increased its sludge equipment by installing an additional battery of twelve tables. The Blue Mound officials stated this addition was necessary because they were losing too much from their eighteen-table slime plant, and declared the plaintiff company was able to get more material than ever before because of this addition. The finding of the court was for the defendant in every particular.

## West End Cross Complaint Involves $1,000,000 Worth of Ore

**Alleges Wrongful Extraction by Tonopah Extension Company—Litigation Started in 1915**

On March 8 the West End Consolidated Mining Co. of Tonopah, Nev., through its attorneys, John P. Gray and H. H. Atkinson, filed a motion in the fifth judicial court of Nevada in which it, as defendant, asks leave to file an amended answer and cross complaint, alleging that the Tonopah Extension Mining Co. has extracted more than $1,000,000 worth of ore from veins apexing in the California claim of the West End company. Permission is also asked to do additional litigation work in the Egyptian and Grand Trunk claims of the plaintiff company. The motion will be heard about the middle of April.

Litigation between the West End and Extension companies was started in 1915, at which time the West End was enjoined from continuing a winze, following a vein which it contended apexed in its own ground, into Tonopah Extension ground. Further development was done, and on April 17, 1923, a stipulation was entered into between the two companies providing for inspection and development work. Since that time considerable development work has been accomplished by both companies, and the motion filed by the West End company would seem to indicate that facts are adjusting themselves toward an early trial or a possible settlement.

## Tonopah Belmont Options Mizpah "Ex" as Development Opens Ore

The Tonopah Belmont Development Co. reports continued favorable development at deeper elevations and on the 1,000 level north of the main shaft. The east drift is still in ore of good grade and the stopes opened from the 1,000 level are producing ore of shipping grade. The vein has been cut on the 900 level, and, though not so rich as on the 1,000 level, is better than minimum mill grade. Drifting may open better ore, as it is likely that the main oreshoot has not yet been opened on the 900 level.

On the strength of the showing in this new vein the Belmont has taken a five-year lease on the westerly five claims of the Mizpah Extension Co., whose property joins the Belmont on the east and north. There are several miles of underground workings in the Mizpah Extension mine. The company itself did considerable work; later the Tonopah Mining Co. did extensive development at deeper elevations, and later still the Halifax Co. did more work. Several small bodies of rich ore were found, but none of important commercial extent. Operating conditions were difficult, so that even though some ore of excellent grade was shipped, the work was never profitable. The Mizpah Extension property has always been regarded as a promising piece of ground, and, although it is likely that $500,000 has already been spent in its development, further work seems justified.

## Anaconda Sells 1,500,000 Lb. of Copper to Washington Power Company

THE wire mill of the Anaconda Copper Mining Co. at Great Falls will soon begin the delivery of an order for thirty cars of copper wire, aggregating 1,500,000 lb., to the Washington Water Power Co. of Spokane. Announcement of the purchase was made at Spokane by M. W. Birkett, general manager of the Washington company.

Delivery of the order will be made as it is needed during the spring. The purchase of copper wire represents a portion of a $2,000,000 development program under way this year with the Washington Water Power Company in connection with expansion and improvements.

## "Electrical" Prospecting Under Way at Empire Zinc Co. Property

The Empire Zinc Co. is using a new method of prospecting at its mines at Hanover, N. M. The prospecting is done from the surface, electricity being used as a determining force. The method is one worked out by a Swedish engineer, H. Lundberg, who claims that important discoveries have been made in Norway by its use. The principle used is the relative conductivity of rock and rock impregnated with metal, or mineral bodies themselves. Conductivity is determined at many points for a given area between two parallel wires charged with electricity.

The practical test made at Hanover is being watched by mining interests throughout the country. The process has been used on the properties of the New Jersey Zinc Co. in Wisconsin—the only test the method has had in the United States. The work at Hanover is being done by the inventor himself, with assistants that he has trained and brought to this country with him. If successful, the method should prove of immense practical value to mining throughout the United States.

## Berry Mine, Near Virginia City, Nev., Will Be Operated

It is reported that the mill equipment formerly used by the Comstock Leasing Co., and that from the old Douglass mill, near Dayton, Nev., is to be moved to the Berry mine in 6-Mile Canyon. The Berry mine, together with other property in the Flowery district, 5 miles east of Virginia City, was under option to the Comstock Merger interests until last November, when alleged disagreement regarding terms resulted in relinquishment of the option. Considerable development work was accomplished and a substantial tonnage of low-grade milling ore was developed. The property is now under option to a group of Virginia City and Reno people, who contemplate production from this developed and partly developed ore with prospects for further development.

## S. H. Worrell Heads Company to Exploit Monte Cristo Mine

**Ball Mill and Flotation Equipment Purchased—Dump Ore To Be Worked First**

The purchase of the Monte Cristo mine in the State of Sonora, Mexico, is announced by S. H. Worrell, former dean of the Texas State School of Mines. A new organization, known as the Monte Crisco Mining Co., has been organized under Mexican laws, with a capital of $500,000. S. H. Worrell is president and general manager. The Mexican office will be in Juarez in the office of Judge Felipe Siejas and the fiscal agents in New York will be George A. Lamb & Co., 1775 Broadway.

The new company took over the property from the Monte Cristo Senora Mines Co. of El Paso, Tex. The property, which consists of 312 acres of ground patented under the Mexican mining laws and a complete equipment of mining machinery, was turned over to the new company upon consideration that it would work it, equip it with proper milling machinery and deliver to the Mines company 15 per cent of the stock of the new company—that is, $75,000 of paid-up stock.

Mr. Worrell is reported to have purchased a ball mill from the El Paso Foundry & Machine Co. and a 40-ton flotation plant from the Groch Flotation Co., at a total cost of $30,000. This equipment will be forwarded to the property as soon as assembled.

No examination of the underground workings, which are extensive, was made, owing to the presence of water, but there is said to be enough ore on the dumps to keep the mill in operation for four years. An estimate of the values in the dumps made by Worrell gives about 1,000,000 oz. of silver in 50-oz. ore. The property was worked by Carlos C. Soto up until his death, about four years ago. Shipments to the El Paso smelter from the mine total $600,000.

## Plan to Develop Ground Adjacent to Old Pioche Producers

The Snyder interests, of Salt Lake City, have recently incorporated the Raymond & Ely Extension Mining Co., which will develop a group of claims adjoining the properties that were the principal producers in Pioche, Nev. An old shaft, sunk in the early days and reputed to be 600 ft. deep, is being retimbered. This shaft was sunk on the extension of the Meadow Valley and Raymond & Ely fissure veins, and little is known of the lateral work run from this shaft in the early 70's. E. H. Snyder is manager.

## Ore in Golden Age Mine

At the Golden Age property, 9 miles from Nelson, B. C., development has opened a good tonnage of ore averaging from $20 to $80 in gold per ton. A new 60-hp. compressor plant with oil engine has been installed, and plans for a concentrator are under consideration. This may be installed as soon as a lower tunnel reaches the oreshoot.

## Underground Mining of Bauxite Started in Arkansas

### Overburden 100 Ft. Thick Makes Stripping Cost Prohibitive—4,000-Ft. Drainage and Haulage Tunnel

By Tom Shiras
*Special Correspondent*

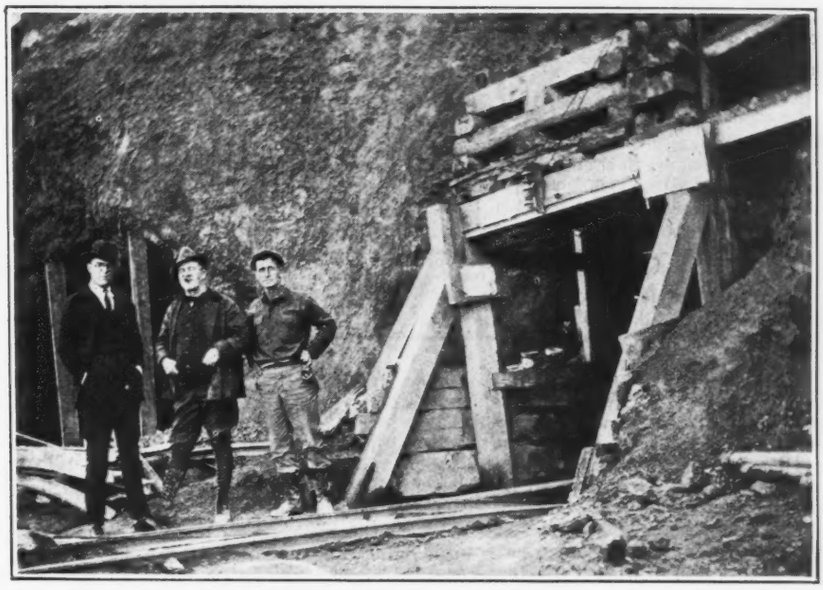
The American Bauxite Co., at Bauxite, Ark., largest producer of bauxite in the country, has recently started underground mining at its property to overcome heavy stripping costs. Until a short time ago all of the ore mined was taken from large open pits, the overburden being removed with steam shovels, scrapers, hand shovels, and steel brooms. For the last few years the overburden, which consists of clay and boulders, has averaged 45 ft., and stripping costs have been extremely heavy. Some of the orebodies lie so deep that this method is prohibitive, on account of cost. Operations from now on will gradually change from a maximum of pit work to a maximum of underground work.

The stripping entails much labor, for all dirt and foreign matter has to be swept from the top of the orebody in order to maintain the grade. Large steam shovels are used down to within a few feet of the top of the ore. Small shovels are used from that point down. Large scrapers are then put onto the job to remove all the dirt that can be removed by that method. Hand shovel men are used next, to remove all the clay from the swags in the top of the orebody, and they are followed by a gang with steel brooms who sweep it clean. The ore is mined and moved to the milling plant by steam locomotives over narrow-gage tracks.

The initial underground operations will cover an area of approximately 160 acres in extent, under which the ore lies at an average depth of 100 ft.

A drainage and haulage tunnel has been driven for a distance of 4,000 ft. along the edge of the orebody. Drifts, or breast stopes, 20 ft. wide are now being driven on 50-ft. centers from the main tunnel, clear through the orebody. This leaves 30 ft. pillars the entire length of the drifts. In cutting these drifts, from a foot to a foot and a half of ore is being left in the roofs, for roof support. As soon as the ore has been mined from the drifts, the roof and pillars will be pulled from the far end (retreating caving method), letting the overburden fall in behind them.

Most of the underground work at this time is being done by negro miners. An electric locomotive has been ordered to use underground, to move cars to the tunnel mouth, where they will be picked up by steam locomotives.



*Mouth of the haulage adit at the American Bauxite Co.'s newly opened underground mine in Arkansas*

## $20,000 Fire Damage in Coyne Concentrator, in Oklahoma

Fire of unknown origin did about $20,000 damage to the Coyne Mining Co.'s mill near Hockerville, Okla., on March 8. The blaze originated in the derrick, and the mill was saved only by prompt and hard work by the Picher fire department. T. F. Coyne, of Webb City, Mo., is the principal owner.

*Negro miners driving breast stope, in the American Bauxite Co.'s underground operations*

## United Verde Extends Scope of Training for Young Engineers

### Experiments Underground Prove Successful—Both Men and Company Benefit

By W. V. DeCamp
Mine Superintendent, United Verde Copper Co.

The plan for training young mining engineers adopted during 1922 by the United Verde Copper Co. in its underground mine at Jerome, Ariz., has proved so satisfactory that it is to be extended to the surface shops and steam-shovel mining operations. The plan originally provided for the employment underground of a certain number of able-bodied graduate engineers. These men, if their applications were accepted, were given employment in one of the many underground operations, with the understanding that they were to serve a minimum of three months at each occupation, provided their work proved satisfactory.

Two years is required for the entire training service, during which time occupations may be changed a maximum of eight times. Semi-monthly lectures on various phases of mine operation accompany this work. The lectures consist of papers prepared by members of the organization, and include all methods of mining in use, as well as organization, first aid, pipe work, track work, tramming, drill repairs, shaft work, development, shaft concreting, and other related subjects.

The completion of the course is not compulsory; a man may quit at any time, or, in the event that he obtains work that is to his liking, he may continue at that indefinitely.

There are seven different methods of mining in use underground, and the opportunity for varied experience therefore is excellent. A large staff of engineers, geologists, and samplers is required and maintained by advancing engineers from underground work. There are at the mine five division foremen, seventeen shift bosses, and

## Moving Picture "Interests," Forty-two Grass Valley Mines, and $25,000,000 Capital, Mix

MINING MEN in San Francisco are more amused than awed by reports emanating from Los Angeles that a corporation, in fact three corporations, are in incubation with the avowed object of merging no fewer than forty-two claims, companies or properties in the Grass Valley-Nevada City gold mining district in California.

According to newspaper announcements the merger includes the Champion, Mountaineer, Gracey, Glencoe, Banner, and other properties. It is stated that a holding company capitalized at $5,000,000 and two operating companies, capitalizd at $10,000,000 each, are to be organized. These imposing figures may be accounted for by the report that the Pantages Pictures Co. and the Vitagraph Co. are backing the project.

Motion pictures of some of the properties were recently taken by camera men for the companies.

F. L. Hudson, "Seattle mining engineer"; Dr. Carl P. Jones, of Grass Valley, and W. H. Martin, of Nevada City, are declared to be interested, along with Los Angeles "backers," with whom they conferred on March 4.

It is a fact that there are numerous prospects in the Grass Valley and Nevada City districts that warrant exploration at greater depths than hitherto attained. A conservative effort is being made in this district to encourage small mining operations. A custom mill has been started and it is the intention to make several other mills available for custom work in the hope that prospectors and small operators can find an outlet for their ores.

thirty-four stope jigger bosses. A position as stope jigger boss enables a young engineer with some experience to be trained in the handling of men and even to be advanced to the position of shift boss. To date approximately thirty men have taken advantage of this training plan, and of these only 10 per cent were entirely unsatisfactory. One man is now a shift boss, several men are jigger bosses, others are miners or timbermen, and almost the entire engineering force, consisting of five geologists' helpers, five samplers, four stope engineers, and four helpers, has been recruited from these men.

Graduate mechanical engineers are to be placed in the various shops, and their work is to be arranged so that they may get from three to six months at each class of work. In addition, men will be engaged in the steam-shovel department in a similar manner.

The training work, although yet in its infancy, has fully demonstrated its value both to the engineer and the company. The men are able to earn as much money as in strictly engineering lines, in addition to obtaining training in actual performance of work so essential to any engineer. Some of them immediately abandon the work for physical reasons; others are so unsuited to mine operation that they are forced to accept subordinate engineering positions, and a few rapidly develop aggressiveness, individuality, and initiative, qualities essential to those holding executive positions.

## Leadville Shaft Reaches 610 Ft.

The shaft of the Leadville Mines Co., operating near Gerlach, Nev., is completed to the 610 level, and station pockets and a sump are being cut preparatory to crosscutting to the vein, an estimated distance of 40 ft. The flotation plant, which has been closed down during the shaft-sinking period, will resume operations as soon as this work is completed.

## Homestake Bonds Uncle Sam Gold Mine in Black Hills

The Homestake Mining Co. has taken a two-year option on the Uncle Sam mine at Roubaix, 10 miles southeast of the company's property at Lead, S. D. Prospecting and development will start at once and should results justify, $125,000 will be paid for the property.

The Uncle Sam, better known as the Clover Leaf, was considered one of the richest gold mines of the Black Hills and was active up to 1905, when work was suspended. Since then the property has been idle. Considerable specimen ore was taken from the mine and about a million in gold was recovered. The property is equipped with a reduction plant and mining machinery and is opened by a shaft over 700 ft. in depth. The present equipment will be replaced by apparatus of a more modern type should the property be taken over by the Homestake company.

## Commerce M. & R. Co. Has Disposed of Huge Pile of "Jack"

During the first ten weeks of 1924 the Commerce Mining & Royalty Co., of Miami, Okla., shipped a total of approximately 22,000 tons of zinc concentrates, which is more than the great majority of the mines in this field shipped during all of 1922. The major portion of this shipment came from the Webber mine, in Kansas, just north of Picher, and most of the remainder from the West Side, a short distance to the east of the Webber. The Webber was a "show place" during 1922 by reason of having the largest pile of zinc concentrate ever accumulated in the district. At one time it contained more than 33,000 tons. This pile has now entirely disappeared. The St. Louis Smelting & Refining Co. is the second largest shipper so far this year, with consignments to date of slightly more than 11,000 tons.

## Michigan Copper Interests Will Submit Tariff Proposal to Other Producers

### Tentative Draft of Bill Being Prepared —District Hard Hit by Present Market Depression—High Yield

A copper tariff bill is in course of preparation and will soon be submitted by a committee of mining men and other citizens of the Michigan copper district to the executives of all the copper-producing companies in the United States. The bill will be subject to reasonable revision, but if its provisions generally are indorsed it will be introduced at this session of Congress. It also is planned to obtain the support of the thousands of stockholders in the copper-producing companies of this country.

William A. Paine, president of the Copper Range company; L. P. Yandell, president of the Mohawk, Wolverine, and Michigan companies, and W. Parsons Todd, vice-president and acting president of the Quincy Mining Co., already have indorsed the proposed tariff on copper, regarding it as the cure and solution of the ills which have demoralized the industry in the United States in the last five years. Gordon Campbell, president of the Calumet & Arizona company, is an active advocate of the plan to urge tariff legislation.

A widespread sentiment favorable to a tariff levy on imported copper for consumption in this country has been created. The Michigan district has taken the initiative, as it has been hard hit by the low price of copper. Mines of the Michigan copper district have reached the limit so far as refined copper yield per ton of rock treated is concerned. The yield has been abnormally high in all properties which have maintained production in the "lean" years since the close of the World War.

How long the mines can continue mining their richest vein areas is a question which is beginning to cause serious concern. The yield fluctuates, but in recent years the average has tended upward. The peak average has been reached, however, and the majority of the mines may have difficulty in maintaining present high returns. The system of close selection generally employed means extensive opening work to obtain the pick of the vein, and development work in some of the properties has been slowed up by shortage of labor. Copper ground averaging 15 to 17 lb. of refined copper per ton was considered worth mining prior to and during the war, but no Lake Superior mine today can afford to hoist and treat rock running under 20 lb. per ton. The Michigan properties have shown a large increase in average yield, which a decade ago would have placed them almost in the "bonanza" class. Some of the mines are obliged to keep operating, even though they are losing money, to safeguard their shafts and openings from crushing and perhaps permanent damage.

The average yield of refined copper per ton of rock treated in the Lake Superior district, grouping all the producing mines, now is 29.5 lb. In 1915 it was 18.83.

## Union Mines Co. Starts New 60-Ton Mill at Pioche

THE mill of the Union Mines Co. at Pioche, Nev., is now being tuned up for operation. The ore supply at the start will be derived from the company's Mendha mine. Ore for three years' continuous operations at the rated capacity of sixty tons daily is blocked out in the mine, besides which a large tonnage of ore is available in the big dumps surrounding the main working shaft. The heads are expected to assay $4.50 in gold, 10.5 oz. silver and 8.5 per cent lead. The ore will be treated by concentration and flotation, two modified Callow cells having been installed and four Wilfley tables. Squires & Gemmill, of Los Angeles, are in charge of operations.

## Russian-American Corporation Gets Mica Concession from Soviet

According to Bernard A. Rosenblatt, president, the Russian-American Mining & Engineering Corporation, of New York, has obtained a concession from the Soviet Government of Russia for 240 square miles of mica fields in Siberia. The deposits are located 600 miles north of Irkutsk, near the Lena gold mines. S. Grossbard is the representative in Russia who has been conducting the negotiations.

Rosenblatt says Grossbard came to this country in 1907 from Poland and was graduated from the University of Colorado School of Mines. In 1917 he went to Russia with Major General Graves. In that year, with the backing of a Los Angeles financier, Grossbard bought up the Vitima Mica Co. according to Rosenblatt. The property was later seized by the Bolsheviki.

In 1921 Grossbard was said to have renewed his negotiations for the mica fields before a commission of the Soviet Government in London. The result was a thirty-six year concession, providing for a 5 per cent royalty to the Soviet Government and freedom of export, except to supply Russia's demand if called upon.

## Alaska Juneau Made Operating Profit of $40,500 in February

During the month of February, the Alaska Juneau company mined and trammed 235,400 tons to the mill at Janeau, Alaska. Total recovery was $171,100, or 72.64c. per ton. Operating expense, including taxes, legal, insurance, and office expenses, totaled $130,500, or 55.44c. per ton. Operating profit was $40,500. Expenditures on capital account and interest were $24,500, leaving $16,000 to surplus for the month.

## Yellow Pine Ships 2,000 Tons Monthly from Goodsprings

### Development of North Orebody Satisfactory—New Shaft Sunk—Zinc Concentrate Calcined Before Shipment

The Yellow Pine Mining Co., operating at Goodsprings, Nev., has completed the development work on the new North orebody. As was expected by Chas. K. Barnes, general manager, it extends from a porphyry dike that cut the bedding planes of the limestone at right angles and also the orebody in the old mine, 330 ft. north to a northwest fault, the extent of which is not yet known. Work to find the northern extension of this ore under the fault is under way at the present time.

On account of the distance from the bottom of the old incline shaft of this new orebody (2,000 ft.), a new verticle two-compartment shaft has been sunk, equipped with a 50-hp. Fulton electric hoist. A 1-ton self-dumping skip and cage for hoisting men has been provided. This new equipment has been in operation since Jan. 1 and is fulfilling expectations.

Current ore shipments amount to 2,000 tons per month, 1,000 tons of which is mixed lead and zinc ore and 1,000 tons zinc and lead concentrate. The zinc concentrate is calcined before shipment. Quarterly dividends of 3c. per share will be paid throughout the year, it is expected. The company to date has paid $2,610,000, but has been non-productive since Dec. 1, 1920.

Irvine Marshall has been mine superintendant since Feb. 1.

## Belgian Corporation Plans Purchase of Entire Mexican Zinc Output

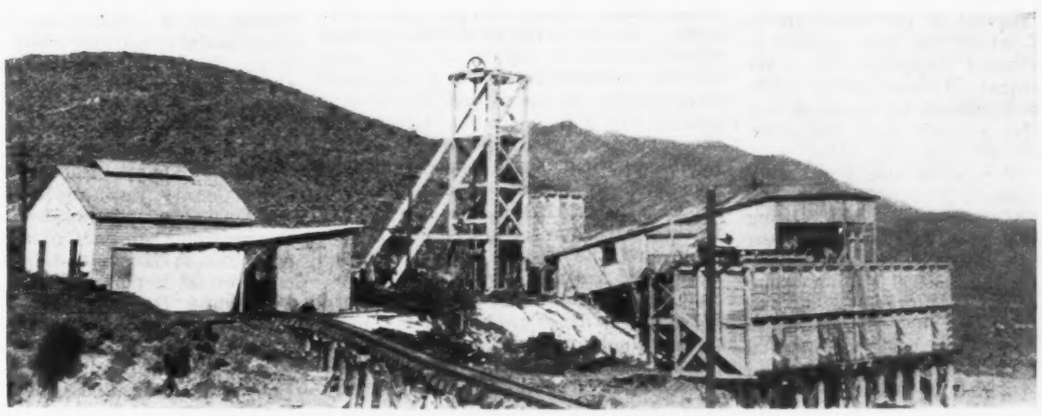
FORMATION of a Belgian corporation, including a score of zinc-consuming companies, for the purpose of contracting for the entire Mexican output of that metal, is reported from Brussels. It is said that the corporation plans to build a concentration plant at Saltillo to handle the product from the states of Chihuahua, Durango, Zacatecas, San Luis Potosi, Coahuila, and Nuevo Leon, and another in Mexico City for the states of Guerro, Hidalgo and Puebla. Storage plants and docks also are planned at Tampico. Belgium has more zinc-smelting capacity than any country except the United States.

## Protest Sales of Timber in Mining Regions to Tie-Hacks

Mine operators in Summit County, Colo., through their county organization, have appealed to the Colorado Metal Mining Association to co-operate with them in their effort to induce the Forestry Service to change its present policy of cutting timber in and adjacent to mining districts.

Year by year the operators have found a decreasing supply of timber, and a corresponding increase in price, while during the same period the Forestry Service has disposed of many of the most desirable tracts which were sold to tie cutters and timbermen to be shipped out of the county.

The Summit County operators contend that the Forestry Service is departing from its declared policy of conservation and preservation of the timber, and is discriminating against the mining interests in favor of one or two tie contractors who employ at the most less than twoscore floating tie cutters or timber men. They assert that in many instances the cost of conducting and supervising the sales to the "tie-hacks" is more than the government receives from the sale of the timber cut.



*Plant of the Yellow Pine Mining Co. at Goodsprings, Nev.*

# London Letter

By W. A. Doman
*Special Correspondent*

## Professional Traders and Rumors Influence Tin Market

### Fluctuations Follow Report of Accumulation in U. S. A.—Dealer Predicts Famine of Tin and Lead

**London, Feb. 28**—One of the topics of the metal market is the price of tin. After its steady rise to about £286 per ton, it slumped about £8, and rather upset some of the speculators. Although the demand is increasing, there is little doubt that there are professionals about keen to dabble and take a profit either on the upward or downward tack. The rapid fall was really caused by heavy sales and rumors that stocks were being accumulated in the United States. So circumstantial were the rumors that the names of Messrs. Ricard and Freiwald—dealers in a very large way—and the American Metal Co. were suggested as the people accumulating. It was even said that Mr. Ricard is at present in the States on this business. The people who started the rumor may have been short of stock, for they confess that they expect to see the price of tin much higher. One of the officials of a leading metal corporation has gone so far as to say that with Europe returning to sanity and work, there will be a famine in tin. He also predicted higher prices for other metals, especially lead. Apart from Mexico he does not see whence additional supplies can come, and the demand for lead is constantly growing.

### Mond Heads New Syndicate

It had been generally thought that the City was fairly well covered with syndicates and investment companies, especially so far as mining is concerned, particularly as one or two of the corporations are not in a position to distribute any profits. Quite an interesting registration has taken place during the week. It is that of the Victoria Syndicate, Ltd. This syndicate has been formed by two groups, the Alfred Mond group and the Central Mining group. They are on a fifty-fifty basis, with Alfred Mond as chairman and Lionel Phillips as deputy chairman. The capital of the syndicate is £270,000, of which the first moiety is held by the Mond group and the other by the Central Mining group. The object of the syndicate is to search for, prospect, and explore land for ores, metals, minerals, oils, or other substances. A little while ago it was suggested that an important finance and investment corporation was being formed, and it may be that the rumor referred to the present Victoria Syndicate. Among the Central Mining group directors is John L. Bergson, who was formerly one of the managers of Sigmund Neumann's business. For a time they looked into the possibility of employing capital in industrial securities.

With the revival in the price of tin it is surprising how many good developments are reported from different mines in Cornwall. It cannot be said that there is any significance in the coincidence, though it has caused a good deal of comment. Unfortunately, information concerning some of the Cornish mines gets into the hands of Stock Exchange dealers before the shareholders know of it, and here much dissatisfaction is expressed. The directors of the Geevor have issued a notice to the effect that very important developments in the Victory section are taking place, and the shareholders will be notified almost immediately. This is a welcome new departure.

# Brisbane Letter

*By Our Special Correspondent for Queensland, Australia*

## Cloncurry, New Lead-Silver District, Looks Better Than Ever

### Corbould Forms Company, to Option Claims—Second Broken Hill, Many Think—Railroad Possible

**Brisbane, Jan. 29.**—The big Mount Isa silver-lead field lately discovered in the Cloncurry district improves as it is opened. It is certainly the most important mineral find made in Australia for many years, and has been commented on in such optimistic terms by the government geologist who has twice inspected it as to make everybody confident that it will develop into a second Broken Hill. Speculators are already busy buying options, and some hundreds of leases have been taken up, despite the hasty and ill-advisesd action of the Minister for Mines in limiting them to ten acres each. Indeed, it is already evident that the field will not be—as from the first it was known it could not be—worked by small parties of men, and development on a big scale is assured. W. H. Corbould, formerly general manager of the Mount Elliott Corporation, and also interested in the Cobalt mine at Cloncurry, has formed a company, capitalized at £450,000, to take over options on a number of the principal leases; and another group of leases is under option to others.

### Sundown Produces Arsenic

A mine called the Sundown, at Ballandean, in the Stanthorpe district, has been taken over by the owners of arsenic works at Wallerngarra, on the New South Wales border, 20 miles away. At the Sundown mines, the lodes of which contain copper, tin, and arsenic, the concentrated ore is first roasted in a Merton furnace, and the arsenic passes into a long circular flue, where the gray oxide is condensed. The residual copper-tin ore is concentrated and separated by means of concentrating tables. Before 1918 these mines were worked for their copper and tin contents and the arsenic went to waste. Later, the arsenic became a byproduct in the treatment of the copper ore. Now, when arsenic has become much more valuable, it is to be the principal metal sought, and copper and tin will be byproducts of the arsenic recovery. The Jibbenhar State arsenic mine, which produces arsenic exclusively, is in the same mineral field as the Sundown mines.

# Washington News

By Paul Wooton
*Special Correspondent*

## Attorney General Will Appeal War Minerals Case

### "Purchase of Property" Claims To Be Contested — Oddie Pushes Appropriation—Net Losses Established

Announcement by the Attorney-General that he will carry to the Supreme Court of the United States the case involving reimbursement under the War Minerals Act of losses growing out of the purchase of property puts an end to the report that no such appeal was to be taken.

Now that it is apparent that the committees, at least, are favorable to the appropriation of further funds to be expended under the War Minerals Relief Act, the War Minerals Relief Commissioner again has taken up actively the review of pending claims. Senator Oddie's bill proposes an additional appropriation of such necessary sum "not exceeding $2,500,000, as may be necessary to satisfy" adjudicated claims.

### Many Claims Disallowed

Findings as to net losses have been made as follows: Andrew Turner, El Dorado County, Calif., $899.44; Downtown Mines Co., Leadville, $4,626; Rex E. Keller, Ferberite, Colo., $2,425.12; L. R. Stokes, Butte County, Calif., $250.30; Daisy Chrome Co., Monterrey County, Calif., $6,792.13; Dale Bros., Placer County, Calif., $520; Rowe, Crain & Malone, Chinese, Calif., $1,514; Marquette Leasing Co., Bisbee, Ariz., $992.45; Wm. H. Graves, Oroville, Calif., $397.39; H. H. Crain, Tuolumne County, Calif., $347; Silver City Manganese Development Co., Grant County, N. M., $1,206.24; Tar Heel Mining Co., Surrey County, N. C., $65.97; Spurgeon, Lunsford & Lunsford, Bowie, Ariz., $2,171.08; Frank D. Rivera, Derry, N. M., $1,372.54; Frank Anderson, Coyote, Calif., $411. Disallowances have been found as follows: W. E. Barney, Del Norte County, Calif., stimulation not established; John H. Haak, Josephine County, Ore., not within the act; Ed Kelly, Alameda County, Calif., stimulation not established; J. Y. Anderson, Rand, Nev., commercial importance not established; Frank Rittigstein, Santa Clara County, Calif., not within the act; Frank Rusconi, Nevada County, Calif., commercial importance not established; Frank T. Paire, Yuma County, Ariz., stimulation not established; Fred E. Potter, Siskiyou County, Calif., not within the act; Hidden Cross Manganese Co., San Bernardino County, Calif., net loss not established; Larsh & Larsh, Leadville, commercial importance not established; Phippen & Davies, Forest Calif., commercial importance not established; Clarence A. Emerald, Mendocino County, Calif., net loss not established; Cooper Shapely, Bishop, Calif., net loss not established; Teaster & Ray, Hampton, Tenn., stimulation not established; Western Reduction Co., Oregon, not within the act.

# Mexico City Letter

By W. L. Vail

*Special Correspondent*

## New Decree by Obregon Specifies Federal Mine Taxes

### Graduated Rates Designed to Encourage Concentrating, Smelting, and Refining in Mexico

**Mexico City, March 6**—Under date of March 4, President Obregon issued a decree changing the pre-existing mining laws of Mexico. Under the new law a tax of 6 pesos annually will be assessed per pertenencia, on from one to five pertenecias; from six to fifty pertenencias, 9 pesos annually; from fifty-one to 100 pertenencias, 12 pesos per pertenencia; and from one hundred and one pertenencias and over, 18 pesos each, annually. Payments must be made, as hitherto, quarterly in advance.

A tax of 5 per cent is assessed on gold ores; 8 per cent on concentrates; 7.5 per cent on bars of bullion; and 7 per cent on refined gold.

Silver ores will pay a tax of 6.5; 6 on concentrates, 5.5 on bars and 5 on refined metal. Values will be based on the New York quotation. These figures are based on silver at 60c. per ounce. The tax will be increased 5 per cent on every raise of 10c. per ounce, or fraction thereof, up to one dollar, when the rate will be 1 per cent for every 10c. or fraction thereof.

The tax on antimony ores or concentrates will be 1 per cent; 0.9 on bars and 0.8 on refined metal.

Copper will pay 2.5 per cent on ores; 2 per cent on concentrates; 1.5 on bars and 1 per cent on the refined metal. This tax is based on 15c. copper in the New York market. For every cent advance in price the tax will be increased 2 per cent.

Taxes on tin are 1.5 per cent on ore and 1 on bars; on crude graphite, 1 per cent and refined 0.5; manganese ore 2 per cent and 1.5 for concentrate; mercury 2.5 and 2; lead 2 per cent on ore, 1.8 on concentrates, and 1.5 on bars; tungsten, 2 and 1.6; zinc ore 1 per cent, concentrates 0.9, bars 0.8 and refined 0.7 per cent.

### Local Taxes Prohibited

As this is a federal tax, no state taxes on mines will be permitted except a single tax not to exceed 2 per cent of the value of gold or silver mined. Local or municipal taxes are prohibited. Out of the Federal returns the government proposes to set aside a certain proportion for municipalities, to be spent for public improvements, by a commission of three persons, one named by the mine owners, one by the local chamber of commerce (or in the absence of such an organization local merchants)—and one by the local city authorities.

A property tax of 5 per cent, per thousand, on the physical assets of mining concerns is also assessed. All taxes are due and payable at the beginning of each quarter. Delay in paying calls for a fine of 10 per cent and upward.

The new law went into effect concurrently with the issue of the decree.

## Would British Columbia Gain by Embargo on Minerals and Metals?

### William Sloan Goes to Ottawa to Discuss Problems of Industry—Present Disposition of Ores

Some question is raised in British Columbia mining circles as to the wisdom of one part of the announced policy of William Sloan, Minister of Mines for the province, who is in Ottawa to take up with the Federal Government a number of subjects pertaining to the mining industry. This concerns the advisability of placing an embargo or other control to prevent the smelting or treatment of Canadian minerals and metals in foreign countries. Other subjects to be considered are the removal or the reduction of the import duty on mining machinery not made in Canada; a dominion grant for mining roads and trails; the transfer of the control of certain mineral rights along the Dominion Railway belt and in the Peace River block from the Dominion to the Provincial Government; and the consideration of the adoption of a uniform taxation of the mineral industry.

### Hardship on Big Producers

Most of these undoubtedly are for the benefit of the mining industry of the province, but an embargo on minerals and metals leaving the country for treatment in foreign countries, if put into effect at this time, certainly would work a hardship on several large producers in British Columbia and Yukon. At present, the Granby company has all its blister copper refined in the United States. If it were refined in Canada, it is doubtful if the dominion could absorb the copper, so most of the refined metal would have to be exported, and little apparently would be gained by the dominion or the province. There is no lead stack on the British Columbia coast, so lead ore from Duthie mines and the Keno Hill mines, in Yukon, is sent either to the Selby or the Bunker Hill & Sullivan smelter. There is a strong probability of lead ores being developed in the Portland Canal and Atlin divisions of British Columbia in the near future, and, lacking a lead stack on the British Columbia coast, these will be sent to the same destinations. The Britannia Mining & Smelting Co., of course, could ship its concentrate to Anyox, but the freight rate would be more than to Tacoma, and already copper mining and smelting has all the charges it can stand. Anyox is not equipped to handle the Premier mine high-grade ore and concentrate as effectively as Tacoma.

## Rich Silver-Lead Ore Found in Chloride Queen Mine

At a depth of 250 ft. high-grade steel galena has been struck in the Chloride Queen mine at Colville, Wash. The ore averages about 2½ ft. wide, and assays as high as 70 per cent lead and 50 to 60 oz. silver have been obtained, according to D. E. Zent, manager. The ore has been followed for 90 ft., and crosscutting from a lower level is under way to pick up the shoot at increased depth.

# Johannesburg Letter

By John Watson

*Special Correspondent*

## Transvaal Platinum, Ltd., Reports Good Assays at 50 Ft.

### Rietfontain Shows Excellent Prospects —69.1 Dwt. Over 61 In. in No. 6 Winze

**Johannesburg, Feb. 10**—The directors of Transvaal Platinum, Ltd., have issued their report for the quarter ended Jan. 31. Development operations have been confined to the two zones of enrichment referred to in the previous report. Up to Dec. 31, 376 ft. of sinking and 107 ft. of crosscutting at the 50-ft. level were completed; also 7,480 ft. of trenching was done. In all, 181 trenches have exposed the lode for a distance of 8,990 ft. on the strike. Now that the assay office on the property is in full operation, close sampling of the trenches can be undertaken.

The lode is being opened up by a series of twelve winzes, a number of which have already reached the 50-ft. level. Values encountered in several of the winzes are low; this is accounted for by the fact that in order to get down to the 50-ft. level as quickly as possible the winzes were sunk vertically and in many cases the lode dipped out of the winzes and, hence, a part of the winzes were off the lode.

The most encouraging results obtained up to date have been from the No. 6 winze on Rietfontain, where the first 16 ft. down gave 69.1 dwt. platinoids per ton over 61 in. The next 26 ft. showed low values, as only a small portion of the lode was exposed in the winze. Crosscuts from the bottom at 50 ft. intersected the lode to the south. The average value for 8 ft. across the lode was 117.1 dwt. Drives east and west have been started on the lode and the average up to date shows, for 24 ft. of driving, 48.6 dwt. platinoids per ton over 63 in. This value is the average of thirty-two samples.

No. 3 winze on Welgevonden has exposed a good-looking lode, and an assay of 54 dwt. platinoids per ton, at 49 ft. depth, over a width of 18 in. was obtained.

The existence of high values at a depth of 50 ft. and the fact that the ore is similar in character to that carrying values near the surface, are favorable indications of a persistence of value in depth.

### Gold Output for January

The following figures show results for the month of January of the twelve leading profit-earning gold mines of the Rand:

| | Tons Crushed | Value or Revenue £ | Cost Ton Milled s. d. | Estimated Profit £ |
|---|---|---|---|---|
| Government areas | 155,000 | 339,573 | 18– 1.6 | 202,270 |
| New Modder | 120,000 | 259,123 | 17– 3.4 | 155,416 |
| Crown Mines | 225,000 | 333,751 | 19– 7.4 | 113,102 |
| Van Ryn Deep | 66,000 | 139,464 | 19– 1.9 | 77,081 |
| Modder Deep | 45,600 | 114,326 | 16– 6.0 | 76,750 |
| Modder B | 68,000 | 138,645 | 18–11.8 | 74,098 |
| City Deep | 100,000 | 186,635 | 22– 7.4 | 73,562 |
| Randfontein Central | 219,000 | 267,536 | 18– 7.4 | 65,053 |
| Springs | 63,000 | 119,811 | 22– 1.1 | 63,025 |
| Brakpan | 75,000 | 122,284 | 20–10.4 | 57,054 |
| Geduld | 70,200 | 116,849 | 18– 9.0 | 50,932 |
| Robinson Deep | 78,000 | ..... | 18– 1.2 | 42,197 |

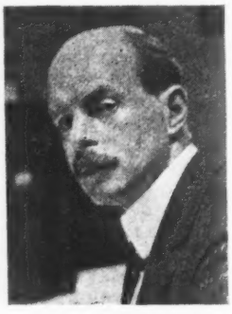
# Recent Technical Publications

Reviews, Abstracts, and References

## Post-graduate Courses in Technical Composition

**Technical Writing.** By T. A. Rickard. Second and Revised Edition. John Wiley & Sons, New York. Price $2.

The year 1923 brought to the editorial desk for review four notable and valuable volumes on technical writing. That publishers find it profitable to produce this form of literature clearly denotes that the writers' labors have not been in vain. The books on English composition by the Right Honorable Sir Clifford Albutt (Macmillan and Company, London) and by Frank Aydelotte, president of Swarthmore College (McGraw-Hill Book Co.), are of the cultural and academic order—welcome and stimulating companions for a quiet hour and a good pipe. Professor S. A. Harburger's "English for Engineers" was reviewed in the *Journal-Press* of Dec. 29, 1923.



*T. A. Rickard*

Mr. Rickard's newly revised and rewritten "Technical Writing" is unquestionably of more intimate and useful appeal to the mining engineer and the geologist-engineer than any of the other works noted. He has culled most of the exhibits of bad writing—and they are indeed many—from his experience in preparing manuscripts for the printer while he was editor of *Engineering and Mining Journal*, the *Mining Magazine*, and the *Mining and Scientific Press*. The examples which he presents of how not to write and how to write were collected in the course of arduous labors in copyreading articles on mining, metallurgical, and geological subjects.

Both the first and second editions of "Technical Writing" reflect evidence of the critical impatience with which the editor confronts a task nearly always made wearing and irritating by lack of attention to the rudiments of correct composition by many if not most writers of technical articles and papers. A critic of Mr. Rickard's book, writing in *Chem. & Met.*, declared the author to be "crotchety and hair-splitting to an extent that arouses impatience and ire," and says, further, that "probably no other work on English composition is capable of arousing such violent disagreement in the reader." After which emission of hot resentment, the reviewer proceeds to inform an anxious technical world that Mr. Rickard "upholds naturalness, clearness and precision in as glorious a manner as a knight battling for the Holy Grail"! The exclamation point is ours. Yet another critic, writing in the *Canadian Mining Journal*, says that Mr. Rickard's work "lacks something of being pellucid. . . . It is clear and forceful, but it *is didactic*"; and, after a column of praise, winds up with the statement that "The book has captured the reviewer's splenetic admiration. No better guide to the use of words is known to him."

Somewhat colloidal comments these. The second edition of "Technical Writing," as a result of the author's labors in revision, amplifies and concentrates the "values" of the original publication. In common with a well-known and extensively advertised soap, it is more than 99 per cent pure. Which is to say that no well-informed person will dispute with him concerning the use of words and the structural forms of composition upon which all authoritative writers on the subjects covered have agreed. There is little basically original or creative about Mr. Rickard's work. Doubtless he would be the last to claim for it any such distinction. His manner of presentation, however, and, as stated, his examples—horrible and otherwise—are for the mining engineer by a mining engineer; and every mining engineer would do well to read the book with care and to follow, in general, its precepts and counsel. Mr. Rickard knows what he is talking—or writing—about. Few if any publishers, however, will permit the adoption of his preferences in the use of the hyphen (Webster having come to be the generally accepted authority) or of his logical but impracticable use of quotation marks. These details are properly the business of the copyreader and the typographer, who should follow the dictionary as to hyphenations, and the accepted forms in indicating quoted matter. Bearing these minor and relatively unimportant features in mind, all writers on technical subjects may accept Mr. Rickard's work as a trustworthy guide. No mining engineer or prospective engineer should be without a copy.

The author generously shares with A. W. Allen and A. B. Parsons, fellow members of the *Journal-Press* staff, and with Cornelius B. Bradley, of the University of California, among others, credit for work upon the manuscript of the revised edition of his book and for reading the proofs.

Mr. Rickard's volume, following an old and courteous custom, is appropriately dedicated to George McLane Wood, Editor of the U. S. Geological Survey.

W. N. P. REED.

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**Useful Minerals of the Russian Far East.** Records of the Geological Committee of the Russian Far East, No. 27, Vladivostok, Siberia. In Russian. Pp. 338. Price 7 gold rubles.

This aims to be a reference book for Russian mining people and also for Americans interested in the mineral resources and the mining industries of Eastern Siberia. Three independent districts are described: Transbaikalia, Amur, and the Maritime Region of Kamchatka province. Each part is accompanied by a map of varying scales, and gives a geographic, geologic, and economic description of the particular region, its history, summary of mineral resources, bibliography, and a complete list of known localities of minerals. The work is more creditable than most of the books that have been published in Russia in the last few years.

I. TOLMACHOFF.

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**Copper Share Statistics**—E. N. Skinner, 25 Broad St., New York City, has just published a new edition of "Copper Share Statistics," giving a large amount of information about over fifty copper companies as gleaned largely from annual reports for each year, 1912 to 1922 inclusive. The price is 50c.

## Patents

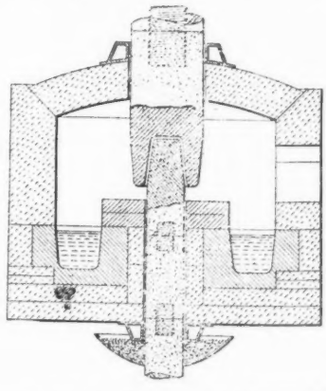
**Flotation Machine** — No. 1,478,703. Dec. 25, 1923. S. H. Dolbear, San Francisco, assignor to Pneumatic Process Flotation Co., New York City. A pneumatic flotation machine in which the ore is distributed in the froth, the gangue settling to the bottom.

**Cottrell Process**—No. 1,478,798. Dec. 25, 1923. A. A. Schmidt, Los Angeles, assignor to International Precipitation Co., Los Angeles. Nos. 1,479,270 and 1,479,271; Jan. 1, 1924. E. R. Wolcott, Los Angeles, assignor to International Precipitation Co., Los Angeles. Improvements in the Cottrell process for precipitating suspended particles from gas by electrical means.

**Rod-Mill Bearing**—Nos. 1,479,172 and 1,479,173. Jan. 1. 1924. David Cole and J. G. Bergman, El Paso, Texas. A flexible roller support for the Cole-Bergman rod mill. It is understood that this new design supplements that formerly used on these mills.

**Rock-drill Valve**—No. 1,479,356. Jan. 1, 1924. L. C. Bayles, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design of a spool valve for rock drills.

**Electric Smelting Furnace** — No. 1,479,662. Jan. 1, 1924. J. H. Gray, New York City. Ores of low-volatile metals are smelted in a furnace in which an arc is maintained between



two vertical electrodes of different diameters so that the upper electrode will direct the heat of the arc downward toward the charge.

**Dry Concentrator** — No. 1,479,754. Jan. 1, 1924. A. H. Stebbins, Los Angeles, Calif. A centrifugal separator for removing the heavy particles from a finely ground dry ore pulp.

## MEN YOU SHOULD KNOW ABOUT

**T. R. Hunt** is at Telluride, Colo.

**William Motherwell** is at Oakland, Calif.

**D. C. Jackling** has returned from Chile.

**George H. Garrey** has returned to San Francisco.

**B. Marcuse**, of New York, has been elected vice-president of the Maple Leaf Asbestos Co.

**G. M. Colvocoresses**, manager of the Southwest Metals Co., Humboldt, Ariz., is in San Francisco.

**Dr. Victor E. Monnett** is acting head of the department of geology of the University of Oklahoma.

**Donald H. Fairchild**, who has been in Arizona on business, has gone to Lower California for a short trip.

**James P. Porteus**, of Lordsburg, N. M., is visiting New Orleans, Chicago, and New York on mining business.

**W. W. Butler**, of Montreal, has resigned from the presidency and directorate of the Hattie Gold Mines.

**W. A. MacKay**, managing director of the Silver Cliff Mining Co., of St. Johns, N. B., is in New York for a short visit.

**H. C. Carlisle**, representing Tonopah Mining Co. interests, has returned to his San Francisco office from Tonopah.

**J. E. Spurr** is delivering a series of lectures on ore magmas at Johns Hopkins University.

**Prof. Heinrich Ries**, of Cornell University, is representing the Geological Society of America on the National Research Council.

**Major Charles C. Seawell** is making geological examinations in the eastern part of New Mexico in the interest of California capitalists.

**F. N. Bendelari**, of Joplin, manager for the Underwriters' Land Co., has been given a two months' leave of absence and will visit his wife and daughters, who are in France.

**J. B. Tyrrell** has made an examination of the Lebel Oro property, Kirkland Lake, on behalf of the Anglo-French Exploration Co., with a view to financial arrangements for further development work.

**Loftus Hills**, government geologist of Tasmania, has received the D. Sc. degree for his thesis on "Metallogenic Epochs of Tasmania." Dr. Hills intends to establish an office in London as consulting geologist.

**H. T. Hamilton**, former manager of the Moctezuma Copper Co., has established his office as consulting mining engineer in San Francisco, in association with **Ira B. Joralemon**, at 1402 California Commercial Union Building.

**Percy R. Middleton** has just completed some flotation experiments for the Mount Morgan Gold Mining Co., which are expected to result in plant modifications. Mr. Middleton's address is care of W. J. Hughes, 127 William St., Melbourne, Victoria, Australia.

**O. H. Fairchild**, of Fairchild & Fairchild, engineers, Chicago, sailed from Seattle on Feb. 26 for Tokyo, Japan, where he will complete the construction work he started for the Nippon Oil Co. before the earthquake forced his return to this country. It is expected that the work will be completed within about four months.

*Louis Vogelstein*

**Louis Vogelstein** was elected chairman of the board of directors of the American Metal Co., Ltd., at the organization meeting of the board on March 11, taking the post vacated by **Berthold Hochschild**, resigned.

*Berthold Hochschild*

**Dr. Philip S. Smith**, head of the geological survey party that is exploring Naval Petroleum Reserve No. 4, in northern Alaska has telegraphed the Department of the Interior that he and his party of a dozen or more men and 140 Eskimo dogs have made their "hop-off" from the last outpost of civilization and will for the next five months be entirely on their own resources and beyond communication.

**Colonel Henry H. Armstead**, president of the Canadian Mines Merger, Ltd., has returned to New York from his Kaslo, B. C., headquarters and will be here one month. His snow-motor tests have been highly satisfactory this winter and he has established a factory in Detroit for building snow motors. The directorate of the Armstead Snow Motor Co. is comprised of A. F. Knoblock, formerly of the Buick Motor Co.; H. H. Armstead, Harold H. Emmons, F. F. Beall, William Knutson, president of the Chevrolet Motor Co.; U. S. Senator R. L. Owen, and Howard Coffin, of the Hudson Motor Co. Besides his civil work, the colonel is attached to the Thirteenth Corps, Engineer Headquarters, Washington, D. C.

## OBITUARY

### Gustav Setz— Pioneer Metallurgist

**An Appreciation by H. A. Wheeler**

In the fullness of his years, and after a forty-one year campaign in lead smelting, Gustav Setz, the pioneer metallurgist of the Southeast Missouri lead district, died at his home in St. Louis on March 2. Mr. Setz was eighty-one years old. From his arrival in this country in 1869 until his retirement from active business in 1910, he was continuously in the harness as a lead metallurgist and was the leader in the development of modern lead-smelting practice in the Mississippi Valley from the pioneer stage of the Scotch hearth and Missouri air furnaces.

Mr. Setz was one of the oldest members of the American Institute of Mining Engineers, having joined it in 1877. Though he never contributed to the technical publications, he left his monument in the modern, large lead smelter at Herculaneum, Mo., that he slowly developed from a couple of little Scotch hearth furnaces. He was the first technical man in Southeast Missouri and blazed the trail for the able professionals who have since made the district the largest lead producer in this country.

**Thomas Southworth**, vice-president and managing director of the Deloro Smelting & Refining Co., a subsidiary of M. J. O'Brien, Ltd., died at Ottawa on March 9, after a month's illness. Mr. Southworth was sixty-nine years old. In his early years he was engaged in journalism at Brockville, Ont., and in 1895 became Director of Forestry for Ontario, resigning in 1907 to become Secretary of the Steel and Radiation Co. Soon afterward he accepted the position he held at the time of his death. Mr. Southworth was a prominent member of the Liberal party, a Mason and a member of the Canadian Mining and Metallurgical Institute. He leaves a widow and two sons.

**Thomas Lilly Darby**, one of the best-known and most active mining engineers of the very early days of Leadville, Colo., died on March 13, at Lexington, Ky.

**R. R. Thompson**, professor of geology at Birmingham University, England, and recently appointed adviser to the West Indian Petroleum Syndicate, died recently.

**J. A. Van Mater**, general manager of mines for the New Jersey Zinc Co., died at Plainfield, N. J., on March 11.

# New Machinery and Inventions

## Controlling an Electric Hoist by Compressed Air

### A Description of the Installation at the Newray Option, of the Coniagas Mines, Schumacher, Ont.

**By H. V. Haight**
Chief Engineer, Canadian Ingersoll-Rand Co., Sherbrooke, Ont.

TWO hoists recently built for Porcupine by the Canadian Ingersoll-Rand Co. have some features which are believed to be novel and interesting. One of the hoists was purchased by Coniagas Mines, Ltd., for its Newray option at Schumacher. The other was purchased by the Porcupine Davidson Gold Mines, Ltd., for its property at South Porcupine.

Each hoist is a double-drum hoist, the two drums being on one shaft and intended for operating normally in balance. Both drums are, however, provided with band friction clutches, so that either drum may be operated independently. The drive is through single reduction Fa'k herringbone gearing, the gear being of cast steel and the pinion of forged steel formed integral with the pinion shaft. Each hoist is designed for a maximum rope pull of 12,000 lb., and a depth of 2,000 ft.

The Newray hoist has drums 60 in. in diameter, 48 in. long, a rope speed of 800 ft. per minute, and is designed for 10,000 lb. unbalanced load. The Porcupine-Davidson hoist has drums of 72-in. diameter, 48-in. long, a rope speed of 1,000 ft. per minute, and is designed for 8,500 lb. unbalanced load.

The motor in each case is a 250-hp. 550-volt, 60-cycle slip-ring hoist motor built by the Canadian Crocker-Wheeler Co.

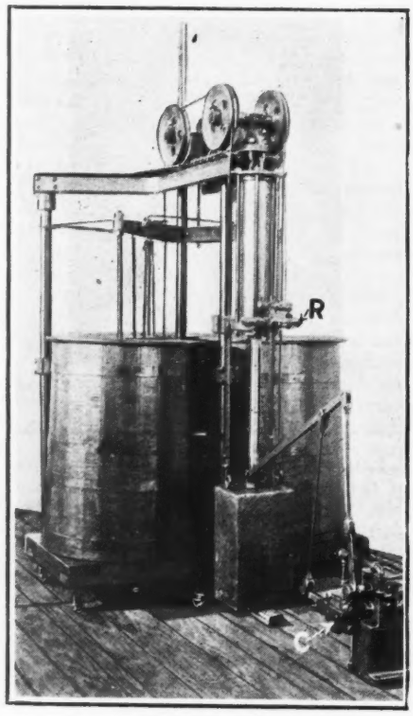



*Fig. 2—Liquid rheostat, controller at right*

#### Compressed Air Control

On each hoist the following features are operated by compressed air devices:

1. Brakes.
2. Friction clutches.
3. Liquid rheostat.
4. Motor acceleration control.
5. Circuit breaker reset.
6. Primary reversing oil switches.
7. Primary switch interlocks.
8. Reverse protection in case of overwind.
9. Emergency stop.
10. Brake regulators for emergency stop.

*Brakes.* Referring to Fig. 1, it will be seen that the brakes are of the post type with parallel motion and stops to give equal clearance all around when released. The brake blocks are sectionalized for easy renewal and in this case are of basswood, but the dimensions are the same as standard asbestos brake blocks. The brakes have floating gear arranged in the usual way to make the brakes follow the motion of the hand lever. The air cylinder is at the top of the brake engine and is controlled by two poppet valves actuated by a hardened cam. There is no oil gag pot. The use of poppet valves instead of piston valves is an important point. Piston valves require a certain amount of lap and permit some leakage. The poppet valves, requiring no lap, give accurate control, and being perfectly tight allow no creeping. Rubber seats are used, so that the valves never have to be ground.

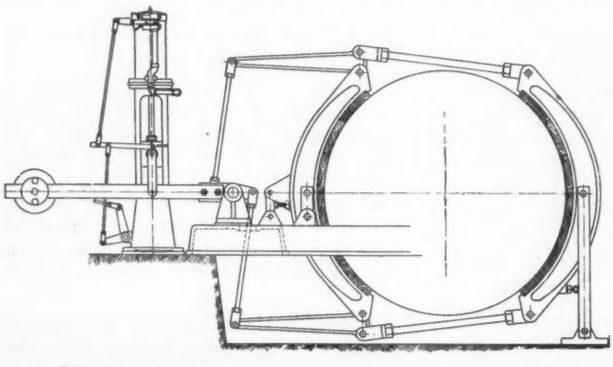


*Fig. 1—Air brake arrangement on Newray hoist*

This air brake may be compared to the oil brake often used on hoists of this type. The oil brake requires a pair of oil pumps with their motors, an accumulator and a sump. The air brake takes the usual mine air supply for normal operation. If the mine is supplied by only one compressor, the hoist will have a small compressor with motor and receiver for emergency supply. The cost of the auxiliary compressor is much less than the cost of two oil pumps and accumulator. The compressed air is much cleaner than the oil, which has a tendency to get all over the hoist. The compressed air takes smaller pipes and valves than the oil. The brake shown in Fig. 1 was found on test to follow the motion of the hand lever accurately and to be absolutely "dead beat," that is, there was no rebound. When the hand lever is moved the brake piston starts quickly and then slows up, comes to its new position accurately and stops. That appears to be all that is required of a brake engine.

*Clutches.* The clutches are of the band friction type operated by a collar sliding on the shaft. In Fig. 4 at either end of the bed, in front, can be seen the air cylinder which operates the clutch. The valve which operates the clutch cylinder is under the operator's platform, controlled by a lever. The valve is similar to the brake valve, consisting of two poppet valves operated by a cam on the hand lever.

The hand levers of the brake and clutch for each drum are interlocked so that both cannot be disengaged at once. Either drum may be hung up in the shaft by setting the brake and releasing the clutch. When one drum is thus hung up, the other can be operated by the motor. It is impossible, however, to let a drum run free, so that the arrangement is very safe.

*Liquid Rheostat.* The principal advantage of a liquid rheostat over those types using metal resistances is that a very gradual change in the resistance is possible and the motor consequently comes up to speed more evenly. This reduces the strain on the ropes and connections and lengthens their life. There is also no danger of the resistance burning out or of starting a fire from overheating.

Fig. 2 shows the rheostat. It consists of three wooden tanks, each having a fixed electrode in the bottom and a movable electrode which is lowered into the liquid till it touches the fixed electrode. The fixed electrodes are connected to the rotor circuit, while the

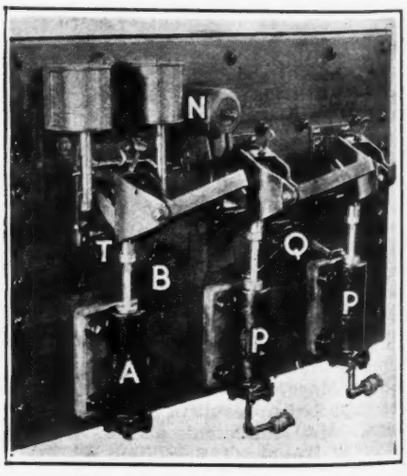



*Fig. 3—Hoist switchboard*

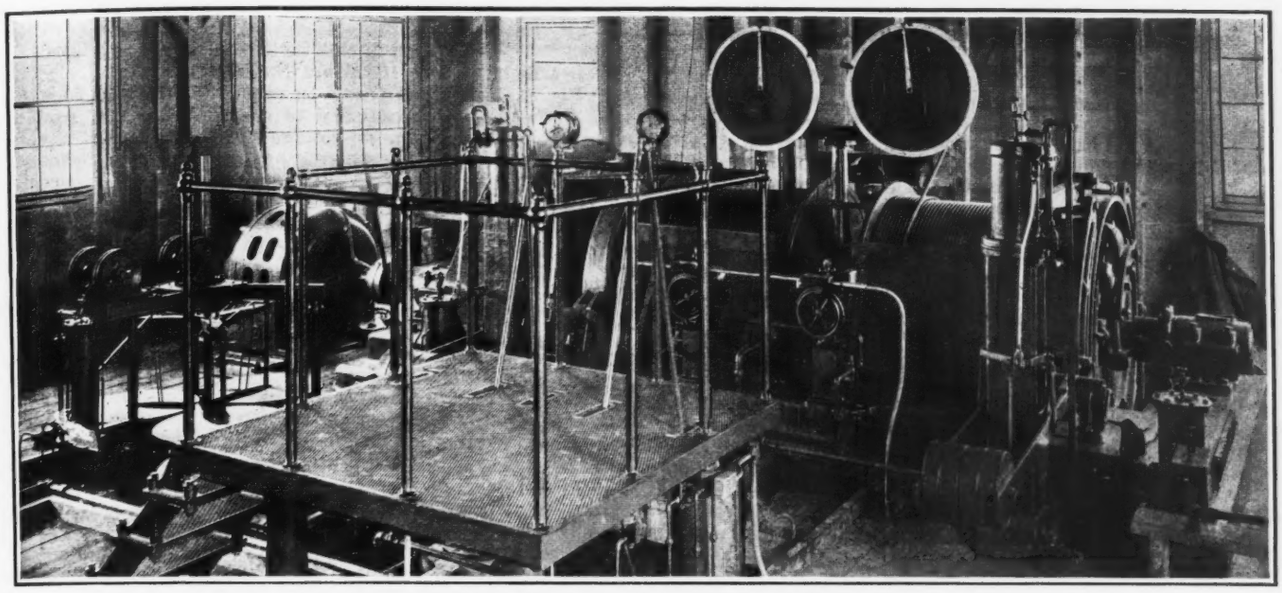


*Fig. 4—Pneumatically controlled electric hoist, of 12,000 lb. capacity, installed at Newrcy Option, Coniagas Mines, Schumacher, Ont.*

movable electrodes are connected together and to earth. The movable electrodes are counter-weighted by the cast iron weight shown. The counter-weight is raised by the air cylinder and the electrodes then move down with their own weight. This arrangement is adopted so that when the air is off the rotor circuit is open. In fact, every function of the hoist is designed so that it goes to "safety," if the air pressure goes off, either by accident or intention. The electrolyte is cooled by a coil cooler, being drawn from the tanks by a circulating pump, forced through the cooler and back into the tanks.

The air cylinder on the rheostat is controlled by a valve on the controller shown at the right in Fig. 2 at *C*. The controller is connected through levers, rods and shaft to the hand lever on the operating platform. If the hand lever is moved slowly, the movable electrodes will follow the motion of the hand lever, but if the hand lever is moved quickly, the electrodes will follow at a predetermined rate. The rate at which the electrodes are lowered into the liquid determines the time in which the motor is accelerated. This time of acceleration is regulated by the acceleration valve.

*Acceleration Valve.* This is on the operator's platform. When wide open it permits the motor to accelerate at the maximum rate for hoisting ore. When partly closed it restricts the air and causes the motor to accelerate more slowly for hoisting men. An electric switch is connected to the acceleration valve to provide for automatically showing a green light in the stations when ready to hoist men.

*Circuit Breaker Reset.* If the circuit breaker should open it may be reset from the operator's platform, but only if (a) the motor is "off"; (b) both brakes are "on." On the switchboard, as shown in Fig. 3. there is an air cylinder *A*. When air is admitted to the bottom of this cylinder it pushes up the toggle that closes the circuit breaker and also pushes up on lever *B*, closing the "no-voltage release" *N*. When air is exhausted again, the piston to cylinder *A* drops, but leaves the rod hanging up, so that the circuit breaker is free to open again. At the same time, lever *B* drops, leaving the "no voltage release" ready to drop again.

Air is admitted to cylinder *A* through three valves in series on the operator's platform. When all three of these valves are open, air is admitted to cylinder *A* and resets the circuit breaker. When any one or more of the valves is closed, air leaks out of cylinder *A* and the circuit breaker is free to open again. The three valves on the operator's platform are located as follows: one is at the central position of the motor control lever and is opened by a cam on the motor control lever whenever that lever is in central or "off" position. The other two valves are located at the forward ends of the slots for the brake levers, which is the "on" position, and are operated by pushing forward lightly on both brake levers at once. The safety feature of this reset will be explained more fully under the heading of "safety devices."

*Primary Reversing Oil Switches.* Referring again to Fig. 3, the circuit breaker is at the left as already described, while the other switches are the primary reversing switches. The reversing switches are of the same design and use many of the same parts as the circuit breaker, but have only four poles each. The circuit breaker and reversing switches were manufactured by the Monarch Electric Co., of Montreal, but the pneumatic devices for operating them were supplied by the hoist builder.

The reversing switches are operated by the air cylinders *PP* shown. The piston rods of the air cylinders have a certain amount of vertical play in the pistons, so that the switches have a quick break. The switches are mechanically interlocked. as shown at *Q* in Fig. 3. In addition there is a compressed air interlock as will be described.

*Primary Switch Interlock (Compressed Air).* Fig. 5 shows the controller for rheostat and primary switches. This controller is also shown at the right in Fig. 3. Lever *B* (Fig. 5) is connected by rods and shaft to the hand lever on operator's platform. Lever *B* moves lever *D* through 2 to 1 gears. Levers *D* and *E* are connected to the floating gear which operates the rheostat valve *C*. Cam *F* operates the primary switch closing valves *G*. Plungers *H* lock the cam *F* so that only one primary switch can be closed at a time.

*Primary Switch Exhaust Valves.* In order that the primary switches may not be opened under full load current, they are not operated directly by the controller (Fig. 5) but are operated from the rheostat in Fig. 2. The primary switch exhaust valves are shown at *R*. They are opened by cams on a rod attached to the counterweight. They open when the weight is in its lowest position, that is, when the rotor circuit is open and the only current flowing in the primary circuit is the magnetising current. The opening of one of the primary switch exhaust valves *R* exhausts air from the corresponding air cylinder *P* (Fig. 3) and also from one of the interlock plungers *H* (Fig. 5). This arrangement insures that:

(a) The primary switches are only required to break the magnetising current.

(b) The motor can only be reversed when the maximum resistance is in the rotor circuit (that is, when the circuit is open).

*Safety Devices.* Provision is made for automatically stopping the hoist by shutting off the motor and applying both brakes under the following conditions:

(a) Overwinding at top or bottom of either shaft.

(b) Overspeeding.

(c) Failure to retard properly when approaching the landing at top or bottom of either shaft.

(d) Overloading the motor.

(e) Failure of electric power.

(f) Failure of compressed air supply.

The stopping of the hoist is controlled through the circuit breaker and attached devices as follows:

Referring to Fig. 3, the no-voltage coil *N* is connected in a pilot circuit which may be opened by various means to be described later. The opening of the pilot circuit allows the armature of *N* to fall, which trips the circuit breaker. The circuit breaker, in opening, trips the air trigger valve, *T*, which in turn opens a large emergency release valve (not shown) letting air out of the brake cylinders and the rheostat cylinder. This sets both brakes, and opens the rotor circuit and the primary switch. The motor is thus shut off completely by the opening of the circuit breaker, the primary switches and the rotor circuit. At the same time both brakes are set by their weights.

Failure of electric power would allow the no-voltage coil *N* to trip the circuit breaker and stop the hoist as described above.

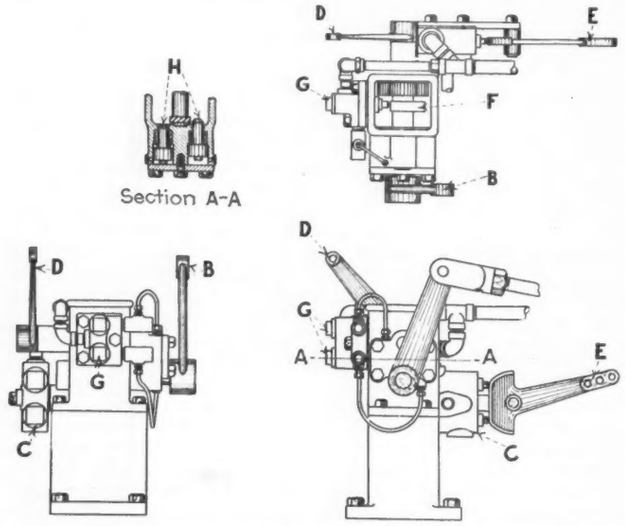



*Fig. 5—Diagrammatic sketch of parts of rheostat controller*

Overloading of the motor will cause the overload coils shown in Fig. 3 to trip the circuit breaker, which will stop the hoist as already described.

Failure of air supply is provided against by the auxiliary air compressor. which has an automatic starter on the motor and will start if the air pressure falls, say, to 70 lb. In the event however, of any accident such as a breakage of a pipe fitting in the air system which would exhaust all air from the system, the hoist would be stopped as follows: The counterweight on the rheostat would open the rotor circuit, and at the same time open the primary switch exhaust valves, which would open the primary switches. Both air brakes would also be set by their weights.

When the hoist has been stopped by the opening of the circuit breaker, the engineer resets the circuit breaker by putting the motor control lever in neutral and the two brake levers in "on" position, as already described. This prevents a runaway when restarting the hoist after an emergency stop.

The various means for opening the pilot circuit to make an emergency stop will now be described.

*Lilly Controllers.* These will be seen below the indicators in Fig. 4. They are driven by the same chains as the indicators. Each Lilly contro ler has a centrifugal governor, overwinding cams for the top and bottom of the travel of cage or skip, a retarding cam, three switches in the pilot circuit, a single stroke mechanical warning gong, a continuous ringing alarm bell with its switch, and a yoke to operate the brake regulator. The Lilly controller acts as follows:

(a) Overspeeding. The governor opens a switch in the pilot circuit and stops the hoist.

(b) Overwinding. One or other of the two cams opens a switch in the pilot circuit and stops the hoist.

(c) Retarding. At the point where the engineer should begin to retard, the single stroke warning gong rings. If the engineer does not then begin to retard, and continue to retard at the predetermined rate, the continuous ringing alarm bell sounds. If the engineer does not heed that bell, the governor opens a switch in the pilot and stops the hoist.

(d) Brake Regulator. The hoist must not be stopped too quickly at high speed, or undue strain will be put on the gears, rope, etc. On the other hand, the brakes must be set quickly in case of overwinding. This is accomplished as follows: In the air pipe leading to each brake engine is a balanced piston valve, controlled by a cam on the Lilly controller. This valve is partly closed when the cage or skip is in the middle of its travel, and is opened by a cam as the cage or skip gradually approaches a landing.

In addition to the above overwinding switches on the Lilly controllers, there is a track limit switch in the headframe for each shaft. This provides against stretch of rope, gives a little closer adjustment of the point of emergency stop than is possible with the cam on the Lilly controller, and is an additional safeguard. It also provides a safety stop while the cams are being set.

The track limit switches are substantial drum-type switches in cast-iron boxes. They are opened by a bar on the cage or skip which strikes a fork on the switch. The switch remains open until the bar closes it again in backing out.

*Emergency Switch.* In addition to the above eight switches for opening the pilot circuit automatically, there is an emergency switch on the operator's platform. This is a single pole enclosed knife switch. It is used to test the emergency stop, and also enables the operator to stop the hoist in case of failure of any of the operating devices, or in case he should become confused.

*Back-out Switches and Reverse Protection.* In case of overwinding, it is necessary to close the circuit through the no-voltage coil before the hoist can be started again. For the sake of safety it is desirable that this circuit should not be closed in such a way that the operator could render any of the safety devices inoperative by failure to open the switch again. It is also desirable that he should not be able to move the cage or skip any farther in the direction in which it is already overwound. This is accomplished as follows:

On the operator's platform are two reverse protection valves, each of which is interlocked with a back-out switch. Each control lever is marked "run" and "back." When the lever is turned to "back," it closes the switch and closes the valve. The closing of the switch closes a shunt circuit through the no-voltage coil which allows the hoist to be started in the right direction. The closing of the valve shuts off the air line to one of the primary switches, which prevents the hoist being started in the wrong direction. If the engineer forgets to turn the lever to "Run" again, after backing out, he cannot hoist again until he has done so.

It would appear that every operating contingency has been provided for. The engineer might even fall in a faint when the hoist was running full speed, and it would be brought to a stop gradually and properly before reaching the end of its travel.

## Portable Graphic Meters Useful in Testing Transformers

By making periodical graphic tests of transformer banks it is possible to secure records which will tell whether transformer installations are of the proper capacity for the plant using the current. These records are obtained with the minimum of attention through the use of portable meters which can be easily installed at the required locations of a mining plant. Thus it is possible for the tests to be made in connection with other duties. Operating one week without attention, the meter gives much interesting information for the user of the current. The wattmeter records shows the maximum demand and the hour and minute when it occurs and such tests show the characteristics of the consumer load and make it possible for the plant furnishing the power to increase or maintain a standard of service. These meters are manufactured by the Esterline-Angus Co., Indianapolis, Ind.

## New Electric Drill for Shop

"Try to stall it" is the slogan which is attached to a new portable electric drill made by the General Electric Co. A special series wound motor, built so that the torque varies inversely with the speed, makes stalling practically impossible even under the most severe working conditions. Gears on the drill are made of heat-treated alloy steel, and run in grease. The control switch is located under the operator's thumb, is simple in design and avoids arcing.

# THE MARKET REPORT

## Daily Prices of Metals

| Mar. | Copper, N. Y. net refinery* | Tin | | Lead | | Zinc |
|---|---|---|---|---|---|---|
| | Electrolytic | 99 Per Cent | Straits | N. Y. | St. L. | St. L. |
| 13 | 13.75 | 56.00 | 56.50 | 9.00 | 9.025 | 6.50@6.525 |
| 14 | 13.75 | 56.375 | 56.875 | 9.00 | 9.00 | 6.50@6.525 |
| 15 | 13.60 | 56.375 | 56.875 | 9.00 | 9.00 | 6.50@6.525 |
| 17 | 13.50 | 56.00 | 56.50 | 9.00 | 8.80 | 6.45@6.50 |
| 18 | 13.375 | 53.00 | 53.50 | 9.00 | 8.80 | 6.375@6.40 |
| 19 | 13.375 | 53.375 | 53.875 | 9.00 | 8.75@8.80 | 6.40 |
| Av. | 13.558 | 55.188 | 55.688 | 9.00 | 8.900 | 6.467 |

*These prices correspond to the following quotations for copper delivered: March 13th and 14th, 14.00c.; 15th, 13.85c.; 17th, 13.75c.; 18th and 19th, 13.625c.

**The above quotations are our appraisal of the** average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

## London

| Mar. | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | | | | | | |
| | Spot | 3M | | Spot | 3M | Spot | 3M | Spot | 3M |
| 13 | 67 | 67¾ | 73¼ | 284¾ | 284 | 38 | 37 | 36 | 35⅞ |
| 14 | 67¼ | 68⅛ | 73 | 285 | 284½ | 37¾ | 36⅞ | 36 | 35¾ |
| 17 | 65⅝ | 66⅜ | 72½ | 283 | 283 | 36½ | 35½ | 35⅝ | 35⅜ |
| 18 | 65¼ | 66¼ | 72 | 263 | 263 | 34⅝ | 33⅞ | 33⅞ | 33½ |
| 19 | 63⅞ | 64⅞ | 71 | 263 | 263 | 35¼ | 34¼ | 34¾ | 34⅜ |

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

## Silver, Gold, and Sterling Exchange

| Mar. | Sterling Exchange "Checks" | Silver | | Gold London | Mar. | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 13 | 4.29¾ | 63⅞ | 33 7/16 | 96s 0d | 17 | 4.28 | 63¾ | 33 7/16 | 96s 3d |
| 14 | 4.28 | 63⅜ | 33½ | 96s 3d | 18 | 4.28 | 63⅞ | 33½ | 96s 3d |
| 15 | 4.28 | 63¾ | 33 7/16 | ..... | 19 | 4.28¾ | 63⅞ | 33 7/16 | 96s 0d |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

## Metal Markets

### New York, March 19, 1924

All of the major non-ferrous metals have declined in price, the principal reason being the effect of the pronounced drop during the week in London. The weakness of the London market is ascribed to the operations of speculators in franc exchange abroad. It seems that many speculators had bought the non-ferrous metals for forward delivery in France, expecting to pay for their orders in depreciated francs and hence making a profit on the "short" side of the franc. When it became evident that, owing to the support of American bankers, the franc would rise, as it did, speculators ordered their metal commitments to be sold, so that they could cover on their franc speculations. The tin market declined £20 over night. Fundamentally, so far as production and consumption are concerned, the situation in Europe has not changed.

### Copper

Earlier in the week sales were fair at 14c. delivered, with many producers actively selling. Last Monday, however, the copper market began to show distinct signs of uneasiness as word of the sharp decline in London was received. Although a few producers began to shade prices they were unable to interest buyers for any but small lots. Hence sales for the week have been light, with consumers naturally waiting to see to what limit the decline in copper would go. Today some metal was sold for 13¾c. per lb. delivered in May. It can be readily obtained for 13⅝c. delivered, from several producers for shipment in March and April, at which price it was sold yesterday. On Tuesday, speculative lots of copper were offered at 13½c. delivered. It is reported that the demand for finished copper products has fallen off in the last two or three weeks. This has affected the brass and wire mills particularly, but they are busy upon old business.

### Lead

The official contract price of the American Smelting & Refining Co. continues at 9c. per lb., New York.

The premiums that some producers occasionally obtained in the lead market have disappeared. During the week the metal was freely sold in New York for 9c. per lb., March and April shipment. In fact one sale was made on a basis of 8.95c. per lb. for March-April-May delivery. In St. Louis, where the heaviest premiums had been asked, the market showed a decided decline. Last Thursday and Friday lead was sold for 9 to 9.05c. per lb., but today it only brought 8.75c. Thus, the normal differential between the two markets is beginning to be expressed in quotations again. It looks as if producers will enter April in an easier position, so far as lead supplies go, than they anticipated a few weeks ago. There is no change in the sound condition of the market. Consumption is still great and no signs of abatement are evident. It would not be surprising to see shipments of ores to lead smelters increase during the present market condition. The lower quotations on the London exchange have made the situation better here. Consumption abroad, however, is not expected to show much change, despite high lead prices.

### Zinc

The zinc market was also one of those to feel the effect of the drop in London. Prices in East St. Louis showed the result at once. Whereas earlier in the week Prime Western metal could be sold for 6.525c. per lb. in that market, yesterday it was sold as low as 6.375c., with a slightly improved tone to the market today, when 6.40c. was being asked. Galvanizers are still seemingly uninterested in making purchases. They made purchases for forward delivery some months back, the effect of which is being felt now. High-grade zinc business has been splendid, with the metal in strong demand by brass manufacturers. It brings from 8½ to 8¾c. per lb.

## Tin

The tin market is so sensitive that it quickly reflects any changes in market conditions, whether brought about by speculation or trade conditions. That is why it showed the effect of the London reaction the quickest and sharpest of any of the metals. There is still a shortage of spot metal in New York. Several steamers which were expected to arrive in March have been delayed by the high winds and storms of the last week. The sharpest decline in the New York market for Straits tin occurred on Tuesday, when the metal dropped from 56.50 to 53.50c. per lb. Arrivals of tin in long tons, March 1 to 18, total 1,085.

## Foreign Exchange

The foreign exchange market has been irregular. The advance in the franc has been the outstanding feature of the week. On Tuesday, March 18, cable quotations on francs were 5.075c.; lire, 4.205c.; and Canadian dollars, 2$\frac{7}{32}$ per cent discount.

## Circulation Statement

Stock of money in the United States, March 1: Gold coin and bullion, $4,338,127,791; standard silver dollars, $500,369,769; subsidiary silver, $277,567,439; United States notes, $346,681,016; Federal Reserve notes, $2,547,961,170; Federal Reserve Bank notes, $12,649,170; National Bank notes, $774,419,202; total, $8,797,775,557. In circulation, per capita, $42.85. Stocks of gold and silver increased $50,000,000 during the month, and notes by $53,000,000.

## Silver

The market has been very steady lately and the tendency is possibly a little better, as India is somewhat more disposed to buy, and the time of year is approaching when seasonal weakness in China ceases, with the prospect of revival of inquiries from that quarter.

**Mexican Dollars**—13th, 48$\frac{3}{4}$; 14th, 15th and 16th, 48$\frac{5}{8}$; 18th and 19th, 48$\frac{3}{4}$.

## Other Metals

Quotations cover large wholesale lots unless otherwise specified.

**Aluminum**—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £115 per long ton.

**Antimony**—Per lb.
Chinese and Japanese brands, 11$\frac{1}{4}$@11$\frac{1}{2}$c.
W. C. C. brand, 13$\frac{1}{4}$c.
Cookson's "C" grade, 15c.
Chinese needle, lump, nominal, 8$\frac{1}{2}$@9c.
Standard powdered needle, 200 mesh, 9@10c.
White oxide, Chinese, 99 per cent $Sb_2O_3$, 9$\frac{1}{2}$@10c.

**Bismuth**—$2.35@$2.45 per lb. London, 10s.

**Cadmium**—70@75c. per lb. London, 2s. 6d.

**Cobalt**—$2.50@$3 per lb. for spot.

**Iridium**—$275@$300 per oz.

**Nickel**—26c. per lb. for 99 per cent virgin metal. London, £130 long ton.

**Osmiridium**—Crude, $58.50 per oz.

**Palladium**—$83 per oz. Crude, $60 per oz.

**Platinum**—March 13 to 17 in., $123; March 18 and 19, $120.
Crude platinum, $113 to $114 per oz. Market weaker.

**Quicksilver**—$62@$68 per 75-lb. flask. San Francisco wires $63.35. London, £11@£11$\frac{1}{4}$.
Market strengthened by advance in London.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given March 8.

## Metallic Ores

**Chrome**—$19.50@$24, depending upon grade and source. Nominal.

**Manganese**—44@46c. per long ton unit, seaport, plus duty.

**Molybdenum**—80c. per lb. of $MoS_2$ for 85 per cent concentrates. Nominal.

**Tungsten Ore**—Per unit, N. Y.
High-grade wolframite, $9@$9.25.
High-grade scheelite, $10.
Ordinary grades, $8.75@$9.

**Iron Ore, Magnetite, Tantalum, Vanadium,** and **Zircon Ore** are unchanged from March 8 quotations.

## Zinc and Lead Ore Markets

**Joplin, Mo., March 15.**—Zinc blende, per ton, high, $46.35; basis 60 per cent zinc, premium, $42; Prime Western, $41@$40; fines and slimes, $39@$37; average settling price, all zinc ore, $42.43.

Lead, high, $129.80; basis 80 per cent lead, $120; average settling price, all lead ores, $125.37 per ton.

Shipments for the week: Blende, 20,894; lead, 1,835 tons. Value, all ores the week, $1,116,620.

It is reported that mines and mills representing around 75 per cent of the output will not be in operation next week, which it is estimated will restrict the production by approximately 11,000 tons. It is hoped this will stay further decline in prices. Heavy shipments this week diminished the visible stock to around 38,000 tons, a third of which is reported sold, the purchases today totaling 12,100 tons.

Lead offerings were lowered $5 today, closing the week on $120 basis.

**Platteville, Wis., March 15**—Blende, basis 60 per cent zinc, $44 per ton. Lead, basis 80 per cent lead, $125 per ton. Shipments for the week: Blende, 352 tons; lead, 32 tons. Shipments for the year: Blende, 5,464; lead, 232 tons Shipments for the week to separating plants, 624 tons blende.

## Non-Metallic Minerals

**Asbestos:**
Crude No. 1—$300@$400.
Crude No. 2—$175@$225.
Spinning fibers—$90@$150.
Magnesia and compressed sheet fibers—$60@$90.
Shingle stock—$50@$70.
Paper stock—$32.50@$40.
Cement stock—$20@$25.
Floats—$7@$9.
All per short ton, f.o.b. mines, Quebec, tax and bags included.

**Bauxite, Barytes, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Graphite, Gypsum, Ilmenite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Pumice, Pyrites, Rutile, Silica, Sulphur, Talc, Tripoli** and **Zircon** are unchanged from March 8 prices.

## Mineral Products

**Arsenious Oxide (white arsenic)**—12@12$\frac{1}{2}$c. per lb., the higher prices being obtained for small tonnages of spot. Demand not yet active.

**Copper Sulphate**—4.90@5c. per lb. Imported material slightly less.

**Zinc Oxide**—Per lb. in bags:
Lead free, 7$\frac{1}{2}$c.
5 per cent lead sulphate, 7$\frac{1}{2}$c.
10 to 35 per cent lead sulphate, 7c.
French, red seal, 9$\frac{3}{4}$c.
French, green seal, 10$\frac{3}{4}$c.
French, white seal, 12c.

**Potassium Sulphate, Sodium Sulphate** and **Sodium Nitrate** are unchanged from the March 8 prices.

## Ferro-Alloys

**Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium** and **Ferrovanadium** are unchanged from the prices given in the March 8 issue.

## Metal Products

**Copper**—Sheets, 21$\frac{3}{4}$c. base; wire, 16$\frac{3}{8}$c.

**Lead Sheets**—Cut, 12.75c.; full, 12.50c. per lb.

**Nickel Silver**—18 per cent Grade A sheets, 27$\frac{1}{4}$c.

**Yellow Metal**—Dimension sheets, 19$\frac{1}{4}$c.; rods, 16$\frac{1}{4}$c.

**Zinc Sheets**—Base price, $9.75 per 100 lb., f.o.b. plant.

## Refractories

**Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick** and **Zirkite** are unchanged from the March 8 prices.

## The Iron Trade

**Pittsburgh, March 18, 1924**

Tubular goods, excepting boiler tubes, wire products, and tin plate, remain firm. Bars are shaded little if at all. In plates and structural shapes there is no little shading on moderate sized orders, apparently a sequel to the booking of so much tonnage at concessions from the regular price of 2.50c., on car orders and fabricated steel jobs. In sheets the bulk of the tonnage being sold by independents is at about $2 a ton concession. The leading interest adheres to its regular prices, 3c. on blue annealed, 3.85c. on black, 5c. on galvanized and 5.35c. on automobile sheets.

**Pig Iron**—The market remains practically stagnant. Consumers are better covered for second quarter than was supposed and production seems to be in excess of consumption. Prices are not quotably changed but are largely nominal: Bessemer, $23.50; basic, $22; foundry, $23, f.o.b. Valley furnaces.

**Connellsville Coke**—Spot furnace has sold at $4, or 25c. under the market of a week ago. Spot foundry remains $5@$5.50. There is no interest in second-quarter contracts just now in either grade.

# German Metal Consumption Increasing

*Special Foreign Correspondence*

OVERVALUATION of the intermediary rentenmark has had a two-edged influence upon the metal trades of Germany. On one hand it has already tended to reduce working expenditure and prompted precise price calculation; on the other it aggravates commercial relations with foreign customers for manufactured metal. British dealers and jobbers are anxious to obtain German orders in old metals derived from dismantled American warships and commercial vessels. They often grant long credits or sell to German friends on the basis of the exchange rate of the day. But the influx of metal scrap into this country is far from being considerable, because of the money shortage among the middle class.

The rate of consumption of metals is on the up grade. So far as copper is concerned, several representatives of American producers vie with one another to acquire the largest orders. Quotations are often below New York parity. The Ruhr companies are now steadily in the market again for copper, owing to the expectation that the high custom duties established by the Allied "Micum" will be lowered. Moreover, the extension of working hours to ten, at wage rates that are often much lower than before the war, enables employers to shade quotations for metallic products to set off in some measure the burden of the occupation. As a matter of fact, German manufacturers of engineering material, sheet, and wire have competed vigorously with Britons, Poles, and Czechoslovakians, whereas it has become difficult to meet the low quotations of the French and Belgians and in a lesser degree of the Italians, who are able to undercut the German prices on account of their depreciated currencies. The last-named three are able to underbid the Germans even in the domestic market as regards galvanized sheets, tin plate, and rolled lead, and manufactured copper sells pretty cheap here. Furthermore, there is a rush of offers from French firms, from time to time, when the franc experiences a fresh fall, for aluminum clippings, which are welcome because alloyed aluminum is in demand in Germany now by the big rolling mills, which are well booked with Indian orders for "squares." The federal railways tacitly grant extra rebates on such consignments as would otherwise not be competitive abroad, owing to the high freights now ruling, and to this purpose harbor fees have also been reduced.

Now that the German metal manufacturers are being helped by foreign credits, in which certain American banks are participating, the amount of copper ordered in the month of February may safely be put at around 9,000 metric tons, of which one-third to one-fourth is casting copper, particularly Lake copper. The railway and postal services, the financial position of which is making headway rapidly, are entering the copper market and bid fair to become good consumers sooner than expected. The postal services are benefiting greatly from their legal monopoly of broadcasting, which is expanding here with remarkable rapidity. Up to the middle of 1923 the public use of broadcasting was in general "verboten." Electrifying schemes that a certain time ago were laid aside by municipalities, states, and private undertakings are now seriously reconsidered, and a great many "tubes" (underground) are to be established as soon as technical designs are approved by the authorities. A conspicuous case is the erection of new underground lines in Berlin and the enlargement of Bavarian water-powers that are under way.

Despite the propaganda of the Imperial Aluminum works, which within a very short time will command a productive capacity of over 40,000 metric tons of electrolytically refined aluminum, per annum, with a lower cost of production, copper holds its own for the reason that the former is now relatively more expensive than the red metal. It again pays to use copper for transmission lines. Copper alloys are once more entering private households from which they were commandeered during the war. Brass kitchen utensils are preferred to tarnishable aluminum wares, but the exorbitantly high frontier custom duties charged by the Micum affect the demand, for a good deal of half-finished metal comes from Ruhr and Rhineland mills.

The northern and Bavarian foundries can now avail themselves of more ample tin imports from Holland and England, and tin smelters are increasing their imports of Bolivian ores. They are now double to three times the average quantity of 1923. On the other hand, tin has been eliminated from babbitt. The consumption of tin amounts now to around 700 tons a month.

Speculation in lead has revived again, for future lead is handled here in terms of French currency on the German metal bourses. It is expected in many circles that a growing demand for lead and zinc on the part of users will manifest itself ere long, since the requirements for these metals are bound to increase with the revival of the building trades. There are plans on hand to erect new smelters in western Upper Silesia, to handle the ores belonging to the Prussian State. Smelters of "raffinade" lead have reduced their smelting charges to compete with British and especially French refineries, and on the whole they are now well employed. Corroders and dye makers who find no more old lead in the market in sufficient quantities are now good consumers of secondary lead. Germany is now turning out heavy quantities of storage batteries, and may take more of American metal. This is also prompted by the separation of the Guggenheim group from the C.E.A., which leads to frequent offers of lead from the new representatives in Berlin. Generally speaking, the rate of lead consumption of this country amounts at present to at least 15,000 metric tons a month and is nearing the mark of 1912 or so.

A sensation was caused here by information that the big zinc and lead mining concern of Giesche, which used to handle zinc independent of the policy of the Zinc Syndicate through established dealers firms, is participating in the new-founded firm "Allgemeine Erz-und Metallhandellsgesellschaft," of Berlin, which is believed to handle the Giesche products. Zinc production of Germany is around 5,500 metric tons a month. There are some accumulations of the metal in the country, because the British outlet was blocked until the end of February, when the 26 per cent recovery act levy was raised by the Labor Government. The zinc market is somewhat obscure for the time being because the problem of uniting the European zinc producers under the lead of Belgium, which was said to be likely to materialize, has taken on fresh energy by the recent fusions in England. Of course the zinc market will profit by the looked-for upswing of the building activities, but, contrary to other metals, no American zinc will be needed in Germany in times to come.

Nickel and silver, which, until recently, were totally neglected, are now very much sought for. Nickel and silver rolling has become again a usual matter as before the exchange crisis. The Mansfeld Co., of Eisleben, is about to complete its silver working plants in view of improving conditions for the exportation of half-finished metal to the Balkan States.

# Gold and Silver Imports and Exports from San Francisco in January, 1924

## Imports

In ore and base bullion

| From | Gold | Silver |
|---|---|---|
| Canada | $136,610 | $101,889 |
| Nicaragua | 37,126 | 12,918 |
| Mexico | 112,683 | 197,837 |
| China | 512,170 | 320 |
| Dutch East Indies | 197,038 | 65,695 |
| Philippine Islands | 156,888 | 2,357 |
| New Zealand | 96,414 | 121 |
| Total | $1,248,929 | $381,137 |
| Coin and other bullion | 48,273 | 15,432 |
| Grand total | $1,297,202 | $396,569 |

## Exports

| | | |
|---|---|---|
| Foreign | | |
| China | ..... | $686,008 |
| Japan | ..... | 453,283 |
| Total 1,790,818 oz. | ..... | $1,139,291 |
| Domestic | | |
| Mexico | $72,365 | ..... |
| China | ..... | $989,231 |
| Hongkong | 13,000 | 32,250 |
| Japan | ..... | 404,976 |
| Total, 2,241,212 oz. silver | $85,365 | $1,426,457 |

The total exports of refined silver for January, 1924, were 4,032,030 oz. The San Francisco price of silver on the basis of declared value for the month was 63.65c. per ounce.

# Company Reports

## Homestake Mining Co.

**Gold; Lead, S. D.**

A report of the operations of the Homestake Mining Co. for 1923 states that normal production, both as to tonnage milled and bullion recovered, has been maintained. No extraordinary betterment program has been carried out. The South mill has passed from the experimental stage to one of continuous and dependable production. The third crusher station and skip pocket at the Ellison shaft is now completed, and ore is being hoisted regularly.

A ventilating fan with a capacity of 225,000 cu.ft. of air per minute, which has been installed and connected to the air shaft by a concrete housing, is now in continuous operation. This has materially improved the air conditions.

The addition to the hospital was completed early in the year, and was immediately opened for the care of patients. Eighty-five per cent of the electric power used in operating the mine and treatment plants was generated by water power, indicating an unusually favorable water condition in the northern Black Hills region.

The engineers report as follows: Development drifts driven, 7,915 ft.; development raises driven, 2,431 ft.; no shaft sinking during the year.

There are 901,549 tons of ore broken down and remaining in the stopes. There are 16,357,168 tons of ore blocked out and remaining in the mine. Developments at the present depth of the mine, which owing to the shortage of labor have been limited during the last few years, indicate that the orebodies are rapidly diminishing in size. Production should continue during the year 1924 at the same rate as obtained during 1923.

During the year 1,652,337 tons of ore were milled, realizing an average of $3.87335.

The statement of operations at the mine during the year 1923 is as follows:

**Revenues**

| | |
|---|---|
| Bullion | |
| Proceeds of bars 5841-6071 | $6,400,078.42 |
| Discount and interest | 65,136.80 |
| Rents | 2,377.48 |
| Total | $6,467,592.70 |

**Operating Expenses**

| | | |
|---|---|---|
| Mine account | | $2,030,769.69 |
| Development | | 19,685.14 |
| B. & M. shaft | | 238,853.57 |
| Ellison shaft | | 155,853.91 |
| Golden Gate shaft | | 1,965.16 |
| Old Brig shaft | | 17,285.78 |
| Tramway | | 70,360.01 |
| Amious mill | | 121,623.22 |
| Golden Star mill | | 21,925.65 |
| Homestake mill | | 8,413.53 |
| Mineral Point mill | | 1,630.22 |
| Monroe mill | | 46,704.76 |
| Pocahontas mill | | 65,393.55 |
| South Mill operation | | 148,741.71 |
| Terraville ball mill operation | | 19,537.24 |
| Regrinding | | 27,013.99 |
| Cyanide No. 1 | | 116,034.38 |
| Cyanide No. 2 | | 53,811.77 |
| Slimes | | 139,086.56 |
| Debris | | 200.00 |
| Freight on bullion | | 16,635.64 |
| Aid fund | | 1,975.95 |
| Benefices | | 9,084.90 |
| Pensions | | 36,049.10 |
| Workmen's compensation | | 22,489.80 |
| Personal injuries | | 2,244.77 |
| Hospital | | 56,071.61 |
| Recreation hall operation | | 31,230.66 |
| Fire protection | | 4,769.09 |
| General expense | | 122,253.01 |
| Office | | 24,645.29 |
| Salaries | | 24,000.00 |
| House expense | | 7,412.49 |
| Legal expense | | 14,868.23 |
| Insurance | | 16,278.62 |
| Taxes | | 447,530.03 |
| Golden Gate M. & T. operation | | 20,250.47 |
| Wyodak C. & M. operation | | 29,811.01 |
| Reserve for depreciation | | 718,789.90 |
| Reserve for depletion | | 624,653.14 |
| Dividends | $1,506,960.00 | |
| Less amount paid from depletion reserve | 575,300.85 | 931,659.15 |
| | | $6,467,592.70 |

The balance sheet of the company is given as follows:

**Assets**

| | Jan. 1, 1923 | Jan. 1, 1924 |
|---|---|---|
| Mines and complete plants | $29,109,758.01 | $29,235,684.60 |
| Less depreciation and depletion | 7,368,209.80 | 8,138,318.49 |
| | $21,741,548.21 | $21,097,366.11 |
| Balance in banks | 905,620.06 | 1,425,132.17 |
| Balance with superintendent | 51,803.59 | 44,785.64 |
| Bullion in transit | 263,492.33 | 318,493.34 |
| United States Government bonds, $1,000,000 par | 999,570.31 | 999,531.25 |
| Accounts receivable | 4,462.93 | 435.68 |
| General supplies | 543,186.99 | 589,948.25 |
| Profit and loss account | 981,519.18 | 981,519.18 |
| | $25,491,203.60 | $25,457,211.62 |

**Liabilities**

| | Jan. 1, 1923 | Jan. 1, 1922 |
|---|---|---|
| Capital stock | | |
| 251,160 shares @ $100 | $25,116,000.00 | $25,116,000.00 |
| Outstanding drafts | 256,044.39 | 205,135.02 |
| Accounts payable | 114,058.25 | 130,975.64 |
| Unclaimed dividends | 5,100.96 | 5,100.96 |
| | $25,491,203.60 | $25,457,211.62 |

## Hecla Mining Co.

**Silver, lead; Burke, Idaho**

A report of the operations of the Hecla Mining Co. for 1923 states that net profit amounted to $1,217,290.37. A fire destroyed most of the surface plant at the mine on July 13, 1923, but the company is now again on a producing basis, although reconstruction is not complete. The first ore was hoisted Jan. 27, 1924, and the first ore sent to the concentrator the following day. Production was gradually raised to 700 tons daily. The company is now building an ore-sorting plant, which, when complete, will permit the handling of a total of 850 tons daily, which will make production equal that in effect before the fire. This plant should be complete in June.

Work has been resumed in the Star crosscut. There remains an estimated distance of 1,050 ft. to advance this work to reach the vein.

Work to date on the Wide West claims has been disappointing. When the vein was intersected in the lower tunnel ore was found of commercial grade but not in commercial quantity. At a later date this work will be resumed, the two levels connected, and an effort made to discover whether ore exists in commercial quantity between them.

The work of sinking a winze below the 2,000 level was begun during the year. This, with other development work now suspended, will be resumed when facilities permit.

Dividends paid during the year amounted to $1,150,000, making total dividends to the end of 1923, $11,105,000.00. With the resumption of operations the company has arranged for adjustment of use and occupancy insurance losses and to accept $614,041.00 in total settlement. Most of this loss accrued during the year 1923.

Ore reserves amount to 1,924,935 tons.

**Balance Sheet as of Dec. 31, 1923**

**Assets**

| | | |
|---|---|---|
| Current assets | | |
| Cash in bank | $21,811.56 | |
| Ore in transit | 5,699.94 | |
| Accounts receivable | 19,927.44 | |
| Interest accrued | 5,235.62 | |
| U. S. Liberty bonds at cost | 276,280.00 | |
| U. S. Treasury bonds 1947-52 | 168,000.00 | |
| Republic of Argentine notes | 49,750.00 | |
| Use and occupancy insurance accrued | 218,493.15 | |
| | | $765,197.71 |
| Working assets—materials and supplies | | 301,293.67 |
| Investments—Sullivan Mining Co. | | 344,107.41 |
| Fixed assets | $2,064,755.25 | |
| Less depreciation reserves | 973,048.79 | |
| | | $1,091,706.46 |
| | | $2,502,305.25 |

**Liabilities**

| | | |
|---|---|---|
| Current liabilities | | |
| Payroll accrued | $32,407.61 | |
| Materials unpaid | 89,576.48 | |
| Taxes accrued | 120,315.02 | |
| Workmen's compensation accounts | 16,253.77 | |
| Miscellaneous accounts payable | 8,804.93 | |
| | | $267,357.81 |

**Capital and Surplus**

| | | |
|---|---|---|
| Capital stock | | |
| 1,000,000 shares, par value 25c., all issued and fully paid | $250,000.00 | |
| Earned surplus | 1,984,947.44 | |
| | | 2,234,947.44 |
| | | $2,502,305.25 |

The income and expenditures for the year were as follows:

**Income**

| | | |
|---|---|---|
| Ore sales—net receipts | $1,946,652.29 | |
| Interest | 39,921.11 | |
| Rents | 6,676.37 | |
| Miscellaneous | 18,443.40 | |
| | | $2,011,693.17 |

**Expenditures**

| | | |
|---|---|---|
| Mining and development | $688,849.95 | |
| Ore sorting | 23,980.29 | |
| Ore haulage—mine to mill | 17,324.45 | |
| Milling | 76,795.55 | |
| Miscellaneous | 145,835.22 | 952,785.46 |
| Operating income | | $1,058,907.71 |
| Depreciation reserves | $75,540.28 | |
| Depletion | 5,857.31 | 81,397.59 |
| | | $977,510.12 |
| Use and occupancy insurance | $468,493.15 | |
| Fire loss and extraordinary expense | 228,712.90 | 239,780.25 |
| Net profit | | $1,217,290.37 |
| Dividends | $1,150,000.00 | |
| Taxes—federal and state | 130,445.68 | 1,280,445.68 |
| Drawn from surplus, Dec. 31, 1922 | | $63,155.31 |
| Surplus, Dec. 31, 1922 | | 2,048,102.75 |
| Surplus, Dec. 31, 1923 | | $1,984,947.44 |

Production amounted to 25,775,188 lb. of lead and 774,316 oz. of silver.

## Chief Consolidated Mining Co.

**Silver, lead; Eureka, Utah**

Only a report of the operations of the Chief Consolidated Mining Co. for 1923 shows net earnings of $812,208.87 and the payment of dividends amounting to $356,479.80. Production amounted to 13,145 oz. of gold, 4,025,792 oz. of silver, 26,498,897 lb. of lead, 1,068,597 lb. of copper, and 367,958 lb. of zinc from 134,312 dry tons of ore. The net return from smelter after charges amounted to $786,964.57, the highest in the history of the company.

The company has outgrown its capital, and it is now planned to provide for more by the issue of additional shares from time to time in such a way as will make it possible for all of the stockholders to take on their respective proportions. The notice to the stockholders for a special meeting to provide the necessary authorization for such new issue will be given soon. A small bond issue may be made in the meantime to provide enough additional capital to serve the requirements for the current year.

Consolidated balance sheet as of Dec. 31, 1923, follows:

**Assets**

| | | | |
|---|---|---|---|
| Property | | | |
| Mining claims—cost | | $2,532,535.80 | |
| Machinery and equipment | | 812,359.69 | |
| | | | $3,344,895.49 |
| Mine investments (at or below cost) | | | |
| Plutus Mining Co. stock | | $99,888.52 | |
| Other investments | | 507,994.58 | |
| | | | $607,883.10 |
| Current assets | | $119,517.66 | |
| Subsidiary companies, balances | | 199,933.64 | |
| Leasers, supplies | | 9,119.87 | |
| | | | $338,955.34 |
| Miscellaneous | | | 501,624.98 |
| Liberty bonds investment | | | 100,528.27 |
| Cash | | | |
| | | | $4,893,887.18 |

**Liabilities**

| | | | |
|---|---|---|---|
| Capital stock: | | | |
| 1,000,000 shares @ $1 | | | $1,000,000.00 |
| Stock premium | | | 215,020.32 |
| Surplus | | | |
| Dec. 31, 1922 | | $2,116,748.56 | |
| Profits | | | |
| Gross receipts from sale of ore and lime rock | $3,457,801.31 | | |
| Less operating costs and reserves for taxes and profit-and-loss items, but exclusive of depletion | 2,670,836.74 | | |
| Net earnings | $786,964.57 | | |
| Interest on investments and deposits | 25,244.30 | | |
| | $812,208.87 | | |
| | | $2,928,957.43 | |
| Less dividends 35, 36, 37 and 38 | | 356,479.80 | |
| | | | $2,572,477.63 |
| Current liabilities | | | 134,153.65 |
| Reserve accounts | | | |
| Taxes | | $603,891.71 | |
| Depreciation | | 273,951.12 | |
| Development | | 94,380.75 | |
| Hospital fees | | 12.00 | |
| | | | $972,235.58 |
| | | | $4,893,887.18 |

## Dolores Esperanza Corporation

**Gold, silver; Chihuahua and Sonora, Mexico**

A report of operations of Dolores Esperanza Corporation for 1923 shows a profit of $171,107.13. The report states that during 1923 65,885 tons of ore was milled; operating and development expense per ton was $12.83. The management has had to contend with higher taxation, adverse legislation, and less efficient labor. Freight rates were increased, and several of the states have enacted complicated labor laws, with particular reference to hours of work, wages to be paid, and indemnities for injury.

The payments to the Mexican Government for taxes and duties were considerably in excess of the amount paid in dividends to stockholders. At present, the Mexican mine owner takes all the risks of failure in a hazardous business, and in the event of success pays 50 per cent of his profits in taxes.

The company shipped to the refinery 12,541.4 oz. of gold, and 1,029,181 oz. of silver in 1923, compared with 12,006 oz. of gold, and 1,127,615 oz. of silver in 1922. Extraction amounted approximately to 96 per cent of the gold and 87 per cent of the silver contents of the ore.

No resumption of operations is contemplated at El Rayo. It will require improved economic conditions, higher prices for silver, and the successful treatment of complex ores and tailings by some metallurgical process to enable the company to operate Creston-Colorado at a profit.

The necessary pumps and other equipment required for unwatering the mine at La Dura were installed, and operations pushed with as much energy as possible. In December extremely heavy rains caused a rapid rise in the Yaqui River and flooded the mine. This means a delay of several months and necessarily adds to the cost of the operation. In the meantime the company expects to ship concentrates to Cumaripa. It takes six to seven days for a pack train to make a round trip to this station.

**Consolidated Profit-and-Loss Account**

| | | |
|---|---|---|
| Operating revenue (Dolores) | | |
| Bullion production: | | |
| Gold—12,541.4 oz. | $258,353.25 | |
| Silver—1,029,181 oz. | 671,298.87 | |
| Sundry rents | 21,236.11 | |
| | | $950,888.23 |
| Non-operating revenue—interest | | 7,711.68 |
| | | $958,599.91 |
| Operating expense (Dolores) | | |
| Mining | $285,970.87 | |
| Milling and cyaniding | 243,468.69 | |
| General expense | 83,283.93 | |
| Bullion taxes and marketing | 112,305.39 | |
| | $725,028.88 | |
| Miscellaneous expense (La Dura and other properties) | 62,463.90 | 787,492.78 |
| Profit carried to surplus | | $171,107.13 |

**Consolidated Surplus Account as at Dec. 31, 1923**

| | | |
|---|---|---|
| Credits | | |
| Surplus as at Dec. 31st, 1922 (adjusted) | | $35,450.40 |
| Add profit for year ended Dec. 31, 1923 | | 171,107.13 |
| | | $206,557.53 |
| Debits | | |
| Development work on property | | $116,477.37 |
| Dividends paid | | 87,249.56 |
| Surplus as at Dec. 31, 1923: | | |
| Dolores Esperanza Corporation | $1,959.96 | |
| Minority interest | 870.64 | 2,830.60 |
| | | $206,557.53 |

**Consolidated Balance Sheet as at Dec. 31, 1923**

**Assets**

| | | |
|---|---|---|
| Current assets | | $ 441,343.23 |
| Concentrates stored in La Dura mine—estimated value | | 110,738.23 |
| Prepaid expenses | | 4,353.58 |
| Claims against Mexican Government for loss and damage, less claims against company | | 135,855.28 |
| Advances to subsidiary — Consuelo Milling, Mining & Power Co. | | 4,869.86 |
| Deferred charges | | 48,045.57 |
| Property account—mines, mining claims, plant and equipment at book value | | 1,059,049.38 |
| | | $1,804,255.13 |

**Liabilities**

| | | |
|---|---|---|
| Current liabilities | | $45,965.80 |
| Reserve for employer's liability | | 4,917.53 |
| Minority holders' interest in capital stock (at par) and in surplus of subsidiary companies | | 23,236.64 |
| Capital stock | | |
| Authorized 1,000,000 shares of $2 each | $2,000,000.00 | |
| Issued and outstanding, including $75.20 scrip | | 1,728,175.20 |
| Surplus | | 1,959.96 |
| | | $1,804,255.13 |

# MINING STOCKS

## Week Ended March 15, 1924

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Alaska-Br. Col. | N. Y. Curb | .... | .... | *40 | .... | .... |
| Anaconda | New York | 34⅛ | 33⅛ | 34 | De.15, Ja.21, Q | 0.75 |
| Aracadian Consol. | Boston | 1⅛ | 1⅛ | 1⅛ | .... | .... |
| Ariz. Com'l | Boston | 9 | 8⅞ | 9 | Ja.15, Ja.31 | 0.50 |
| Calaveras | N. Y. Curb | .... | .... | 1⅛ | .... | .... |
| Calumet & Arizona | Boston | .... | .... | *43½ | Mc.7, Mc.24, Q | 0.50 |
| Cal. & Hecla (New) | Boston | 16½ | 15⅝ | 16 | De. 1, De. 17 | 0.50 |
| Canario Copper | N. Y. Curb | 2 5/16 | 2 5/16 | 2⅛ | .... | .... |
| Cerro de Pasco | New York | 46⅞ | 46 | 46½ | Ja. 17, Feb. 1 | 1.00 |
| Chile Copper | New York | 27⅛ | 26⅞ | 27⅛ | Mh.1 Mh.20, Q | 0.62½ |
| Chino | New York | 17⅛ | 16 | 16½ | Sept. '20, Q | 0.37½ |
| Con. Coppermines | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | .... | .... |
| Copper Range | Boston | 24 | 22½ | 23½ | May '23, Q | 1.00 |
| Crystal Copper | Boston Curb | 76 | 73 | 75 | .... | .... |
| Davis-Daly | Boston | 4⅛ | 4 | 4⅛ | Mar. '20, Q | 0.25 |
| East Butte | Boston | 4½ | 4½ | 4⅜ | Dec. '19, A | 0.50 |
| First National | Boston Curb | 33 | 25 | 30 | Feb. '19, SA | 0.15 |
| Franklin | Boston | *90 | *80 | *80 | .... | .... |
| Gadsden Copper | Boston Curb | *40 | *39 | *39 | .... | .... |
| Granby Consol. | New York | 15 | 15 | 15 | May '19, Q | 1.25 |
| Greene-Cananea | New York | 15 | 14⅛ | 14⅛ | Nov. '20, Q | 0.50 |
| Hancock | Boston | 1⅜ | 1⅜ | 1⅜ | .... | .... |
| Howe Sound | N. Y. Curb | 2⅜ | 2⅜ | 2⅜ | Ap.1, Ap.15, Q | 0.05 |
| Inspiration Consol. | New York | 24⅞ | 24⅛ | 24⅛ | De.20, Ja.7, Q | 0.50 |
| Iron Cap | Boston Curb | 3 | 2⅞ | 3 | May 23, K | 0.15 |
| Isle Royale | Boston | 16 | 15½ | 16 | Se. 1, Se. 15, | 0.50 |
| Jerome Verde Dev. | N. Y. Curb | 1⅜ | 1⅜ | 1⅜ | .... | .... |
| Kennecott | New York | 36⅛ | 35⅞ | 36 | Mc.7, Ap. 1, Q | 0.75 |
| Keweenaw | Boston | *85 | *60 | *85 | .... | .... |
| Lake Copper | Boston | †2 | †1½ | 1½ | .... | .... |
| Magma Copper | New York | 36⅛ | 33½ | 35½ | Jan. '19, Q | 0.50 |
| Mason Valley | N. Y. Curb | 1⅜ | 1⅜ | 1⅜ | .... | .... |
| Mass Consolidated | Boston | *75 | *75 | *75 | Nov. '17, Q | 1.00 |
| Miami Copper | New York | 22⅛ | 22 | 22⅛ | Fe. 1, Fe. 13, Q | 0.50 |
| Michigan | Boston | .... | .... | *50 | .... | .... |
| Mohawk | Boston | *32⅜ | *32⅛ | *32⅛ | Se. 22, Oc. 13, | 1.00 |
| Mother Lode Coa. | New York | 8⅛ | 8⅛ | 8⅛ | De.14, De.31 | 0.50 |
| Nevada Consol. | New York | 13⅜ | 13 | 13 | Sept. '20, Q | 0.25 |
| New Cornelia | Boston | *17⅛ | *17⅛ | *17⅛ | Au.3, Au.20, Q | 0.25 |
| New Dominion | N. Y. Curb | 3 | 2⅞ | 2⅞ | .... | .... |
| North Butte | Boston | 2⅞ | 2⅞ | 2⅞ | Oct. '18, Q | 0.25 |
| Ohio Copper | N. Y. Curb | *78 | *72 | *72 | .... | .... |
| Old Dominion | Boston | 17⅛ | 17⅛ | 17⅛ | Dec. '18, Q | 1.00 |
| Osceola | Boston | .... | .... | 31⅛ | June '23, Q | 1.00 |
| Phelps Dodge | Open Mar. | †140 | †120 | .... | De.20, Ja.2 Q | 1.00 |
| Quincy | Boston | 20⅛ | 20 | 20 | Mar. '20, Q | 1.00 |
| Ray Consolidated | New York | 10⅛ | 9⅞ | 10 | Dec. '20, Q | 0.25 |
| Ray Hercules | N. Y. Curb | *15 | *10 | *15 | .... | .... |
| St. Mary's Min. Ld. | Boston | *30⅛ | *30⅛ | *30⅜ | No.9, De.11, K | 1.00 |
| Seneca Copper | New York | 5⅛ | 4⅞ | 4⅞ | .... | .... |
| Shannon | Boston | †*60 | †*45 | *55 | Nov. '17, Q | 0.25 |
| Shattuck Arizona | New York | 6 | 5⅛ | 6 | Jan. '20, Q | 0.25 |
| South Lake | Boston | †*75 | †*25 | *25 | .... | .... |
| Superior & Boston | Boston | *98 | *84 | *90 | .... | .... |
| Tenn. C. & C. cfs. | New York | 7⅛ | 7⅛ | 7⅛ | De.31, Ja.15, Q | 0.25 |
| Tuolumne | Boston | .... | .... | *42 | May '13, | 0.10 |
| United Verde Ex. | N. Y. Curb | 26 | 25⅛ | 26⅛ | Ja.1, Fe. 1, Q | 1.00 |
| Utah Consol. | Boston | .... | .... | *1 | Sept. '18, | 0.25 |
| Utah Copper | New York | 67⅛ | 65⅛ | 67 | Mc.14, Mc.31, Q | 1.00 |
| Utah Metal & T. | Boston | *40 | *40 | *40 | Dec. '17, | 0.30 |
| Victoria | Boston | †*90 | †*65 | *65 | .... | .... |
| Walker Mining | N. Y. Curb | 3⅛ | 3 | 3 | .... | .... |
| Winona | Boston | *35 | *35 | *35 | .... | .... |
| Wolverine | Boston | .... | .... | 5⅛ | .... | .... |
| **NICKEL-COPPER** | | | | | | |
| Internat. Nickel | New York | 14⅛ | 13 | 13⅜ | Mar. '19, | 0.50 |
| Internat. Nickel pfd. | New York | 79 | 79 | 79 | Ja.17, Fe.1, Q | 1.50 |
| **LEAD** | | | | | | |
| Carnegie Lead & Zinc | Pittsburgh | 3 | 2⅞ | 3 | .... | .... |
| National Lead | New York | 140⅛ | 136 | 140⅛ | Mc.14, Mc.31, Q | 2.00 |
| National Lead pfd. | New York | .... | .... | 114⅛ | No. 23, De. 15 | 1.75 |
| St. Joseph Lead | New York | 26⅛ | 25⅛ | 26⅛ | Ju.10, Ju.20, QX | 0.50 |
| **ZINC** | | | | | | |
| Am. Z. L. & S. | New York | 8⅛ | 8⅛ | 8⅛ | May '20 | 1.00 |
| Am. Z. L. & S. pfd. | New York | 31 | 31 | 31 | Nov. '20, Q | 1.50 |
| Butte C. & Z. | New York | 5⅛ | 5 | 5⅛ | Ma. '23, | 0.50 |
| Butte & Superior | New York | 17⅛ | 16⅛ | 17⅛ | Je.15, Je. 30, Q | 0.50 |
| Callahan Zn-Ld. | New York | 4⅛ | 4⅛ | 4⅛ | Dec. '20, Q | 0.50 |
| New Jersey Zn. | N. Y. Curb | .... | .... | 151⅛ | Ja.31, Fe.9 | 2.00 |
| United Zinc | N. Y. Curb | .... | .... | *25 | .... | .... |
| Yellow Pine | Los Angeles | .... | .... | *80 | Dec. '23 | 0.03 |
| **SILVER** | | | | | | |
| Alvarado | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | .... | .... |
| Batopilas Mining | New York | ⅛ | ⅛ | ⅛ | Dec. '07, I | 0.12 |
| Beaver Consol. | Toronto | †*32 | †*28⅛ | *28⅛ | May '20, K | 0.03 |
| Castle-Trethewey | Toronto | *78 | *70 | *78 | .... | .... |
| Coniagas | Toronto | 2.20 | 2.20 | 2.20 | Oc.19, No.1, '23 | 0.02½ |
| Crown Reserve | Toronto | †*64 | †*63 | *63½ | Jan. 17, | 0.05 |
| Kerr Lake | N. Y. Curb | 1⅜ | 1⅜ | 1⅜ | Ap.1, Ap. 15, Q | 0.12½ |
| La Rose | Toronto | †*23 | †*21½ | *20½ | Apr. '22, | 0.10 |
| McKinley-Dar.-Sav. | Toronto | *17 | *15½ | *16½ | Oct. '20, Q | 0.03 |
| Mining Corp. Can. | Toronto | 3.53 | 3.38 | 3.53 | Sept. '20, Q | 0.12½ |
| Nipissing | N. Y. Curb | 6⅛ | 6⅛ | 6⅛ | Mc.1, Ap.21, Q | 0.03 |
| Ontario Silver | New York | .... | .... | 6 | Jan. '19, Q | 0.50 |
| Temiskaming | Toronto | *31 | *31 | *31 | Jan. '20, K | 0.40 |

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **GOLD** | | | | | | |
| Alaska Gold | New York | ⅛ | ⅛ | ⅛ | .... | .... |
| Alaska Juneau | New York | 1⅛ | 1 | 1 | .... | .... |
| Carson Hill | Boston | 1⅜ | 1⅜ | 1⅜ | .... | .... |
| Cresson Consol. G | N. Y. Curb | 4⅛ | 4 | 4 | De.31, Ja.10, Q | 0.1 |
| Dome Mines | New York | 18⅛ | 17⅛ | 18⅜ | Mc.26, Ap.21, Q | 0.5 |
| Golden Cycle | Colo. Springs | 1.26⅜ | 1.24 | 1.26⅛ | De. '22, Q | 0.0 |
| Hollinger Consol. | Toronto | †12.10 | †12.00 | 11.95 | Mc 6, Mc.24, M | 0.0 |
| Homestake Mining | New York | 50 | 49⅛ | 50 | Mc.20, Mc.25, M | 0.5 |
| Kirkland Lake | Toronto | *22⅛ | *21 | *21 | .... | .... |
| Lake Shore | Toronto | †3.91 | †3.85 | 3.82 | Fe.2, Fe.24, Q | 0.02 |
| McIntyre-Porcupine | New York | 16⅛ | 15⅛ | 15⅛ | De. 1, Ja. 2, | 0.2c |
| Portland | Colo. Springs | *54 | *50 | *50 | Oct. '20, Q | 0.01 |
| Teck-Hughes | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | .... | .... |
| Tom Reed | Los Angeles | *51 | *49 | *49 | Dec. '19, | 0.02 |
| United Eastern | N. Y. Curb | *90 | *84 | *86 | Ja.8, Ja.28, Q | 0.15 |
| Vipond Cons. | Toronto | †1.27 | †1.27 | 1.24 | .... | .... |
| Wright-Hargreaves | Toronto | 3.15 | 3.10 | 3.10 | Mc.15, Ap. 1, Q | 0.02½ |
| Yukon Gold | N. Y. Curb | *62 | *60 | *60 | June '18, | 0.02 |
| **GOLD AND SILVER** | | | | | | |
| Boston-Mont. Corp. | N. Y. Curb | .... | .... | *16 | .... | .... |
| Con. Cortez | N. Y. Curb | *70 | *65 | *65 | .... | .... |
| Con. Virginia | San Francisco | *5⅛ | *4⅛ | *4⅛ | .... | .... |
| Continental Mines | N. Y. Curb | 2⅛ | 1⅛ | 1⅜ | .... | .... |
| Dolores Esperanza | N. Y. Curb | *55 | *50 | *50 | Jy. 1, Jy. 10 Q | 0.05 |
| Jib Consol | N. Y. Curb | *35 | *24 | *33 | .... | .... |
| Premier Gold | N. Y. Curb | .... | .... | 2 | .... | .... |
| Tonopah Belmont | N. Y. Curb | *67 | *62 | *62 | Apr. '23, Q | 0.05 |
| Tonopah Divide | N. Y. Curb | *36 | *36 | *36 | Se.22, Oc. 10 | 0.10 |
| Tonopah Extension | N. Y. Curb | 1⅛ | 1⅛ | 1⅜ | Mc 11, Ap. 1 | 0.05 |
| Tonopah Mining | N. Y. Curb | 1⅛ | 1 1/16 | 1⅛ | Ap. 6, Ap. 21 | 0.07½ |
| Unity Gold | N. Y. Curb | 2⅛ | 1⅞ | 2 | .... | .... |
| West End Consol. | N. Y. Curb | *68 | *62 | *62 | Mar. '23, Q | 0.05 |
| **SILVER-LEAD** | | | | | | |
| Ahumada | Boston Curb | 6 | 5⅛ | 5⅜ | Mc., Ap. 2, | 0.07½ |
| Bingham Mines | Boston | .... | .... | 16⅛ | Sept. 19, Q | 0.25 |
| Cardiff M. & M. | Salt Lake | 1 | 1 | 1 | Dec. '20, | 0.15 |
| Chief Consol. | Boston Curb | 4 | 3⅜ | 3⅞ | Ja 11, Fe.1, Q | 0.10 |
| Columbus Rexall | Salt Lake | *27 | *23⅛ | *26⅛ | Aug. '22 | 0.03 |
| Consol. M. & S. | Montreal | 37⅛ | 36 | 36⅛ | Oct. '20, Q | 0.62½ |
| Daly Mining | Salt Lake | 2.15 | 2.00 | 2.15 | July '20 | 0.10 |
| Erupcion | Boston Curb | 2⅛ | 2⅛ | 2⅛ | Mc 15, Ap.2, | 0.07½ |
| Federal M. & S. | New York | .... | .... | 11⅛ | Jan., '09 | 1.50 |
| Federal M. & S. pfd. | New York | 45⅛ | 43⅛ | 45 | Fe.26, Mh.15, Q. | 1.75 |
| Florence Silver | Spokane | *20 | *20 | *20 | Apr. '19, QX | 0.01 |
| Hecla Mining | N. Y. Curb | 9⅛ | 9⅛ | 9⅛ | Fe.15, Mh.15Q | 0.25 |
| Indian Mines | N. Y. Curb | .... | .... | *64 | .... | .... |
| Iron Blossom Con. | N. Y. Curb | .... | .... | *31 | Oct. 26, '23, | 0.02 |
| Marsh Mines | N. Y. Curb | *11 | *11 | *11 | June '21, I | 0.02½ |
| Park City | Salt Lake | †4.75 | †4.50 | 4.75 | Jan. 24, | 0.15 |
| Park Utah | N. Y. Curb | .... | .... | 4⅛ | De.8, Ja.2, Q | 0.15 |
| Prince Consol. | Salt Lake | .... | .... | *75 | Nov. '17, | 0.02 |
| Silversmith | Spokane | *37⅛ | *33 | *37⅛ | De. 31, Ja. 10 | 0.02 |
| Simon Silver-Lead | N. Y. Curb | .... | .... | *1 | .... | .... |
| Tamarack-Custer | Spokane | 2.04 | 1.60 | 1.80 | Se.30, Oc. 1, K | 0.02 |
| Tintic Standard | Salt Lake | 4.75 | 4.40 | 4.75 | Ja. 5, X | 0.25 |
| Utah-Apex | Boston | 3 | 2⅞ | 3 | June '23, QX | 0.50 |
| **IRON** | | | | | | |
| Bethlehem Steel | New York | 57⅛ | 55⅛ | 56 | Mh. 1, Ap. 1, Q | 1.25 |
| Char. Iron | Detroit | 1 | 1 | 1 | .... | .... |
| Char. Iron pfd. | Detroit | .... | .... | 1⅛ | .... | .... |
| Colorado Fuel & Iron | New York | 35⅛ | 30⅛ | 32⅛ | Fe.11, Fe.25 Q | 2.00 |
| Col. Fuel & Iron pfd. | New York | .... | .... | 102 | Fe.11, Fe.25, Q | 2.00 |
| Gt. North'n Iron Ore | New York | 29⅛ | 28⅛ | 29⅛ | De.10, De.27 | 2.00 |
| Inland Steel | N. Y. Curb | .... | .... | 46 | Mh.15, Apl. 1 Q | 0.62½ |
| Mesabi Iron | N. Y. Curb | 6⅛ | 6 | 6 | .... | .... |
| Replogle Steel | New York | 11 | 10⅛ | 10⅛ | .... | .... |
| Republic I. & S. | New York | 56⅛ | 54⅛ | 55⅛ | May '21 | 1.50 |
| Republic I. & S. pfd. | New York | 92⅛ | 92 | 92⅛ | Mh.20, Ap.1 QX | 2.75 |
| Sloss-Sheffield S. & I. | New York | 62⅛ | 60⅛ | 62⅛ | Mc.10, Mc.20 | 1.50 |
| Sloss-Shef. S. & I. pfd. | New York | .... | .... | 84 | De.20, Ja.2, Q | 1.75 |
| U. S. Steel | New York | 103⅞ | 101⅛ | 102⅛ | Mc. 29, QX | 1.75 |
| U. S. Steel pfd. | New York | 119⅛ | 118⅛ | 119 | Mc. 29, Q | 1.75 |
| Virginia I. C. & C. | New York | .... | .... | 49 | De.15, Ja. 2 | 1.50 |
| Virginia I.C.&C.pfd. | New York | .... | .... | 80 | De.15, Ja.22 | 2.50 |
| **VANADIUM** | | | | | | |
| Vanadium Corp. | New York | 31⅛ | 30⅛ | 30⅛ | Jan. '21, Q | 1.00 |
| **ASBESTOS** | | | | | | |
| Asbestos Corp. | Montreal | 35 | 35 | 35 | Se.29, Oc.15 Q | 1.00 |
| Asbestos Corp. pfd. | Montreal | 60 | 59 | 60 | Se.29, Oc.15, Q | 1.50 |
| **SULPHUR** | | | | | | |
| Freeport Texas | New York | 11⅛ | 9⅞ | 10⅛ | Nov '19, Q | 1.00 |
| Texas Gulf | New York | 61⅛ | 60⅛ | 60⅛ | Mh.3, Mh.15 QX | 1.75 |
| **PLATINUM** | | | | | | |
| So. Am. Gold & P. | N. Y. Curb | 4 | 3⅛ | 3⅛ | .... | .... |
| **MINING, SMELTING AND REFINING** | | | | | | |
| Amer. Metal | New York | 43⅜ | 42⅛ | 43⅛ | Fe.18, Mh.1, Q | 0.75 |
| Amer. Metal pfd. | New York | .... | .... | 112 | Fe 20, Mh.1, Q | 1.75 |
| Amer. Sm. & Ref. | New York | 63⅛ | 60⅛ | 62⅛ | Ja. 11, Fe. 1, Q | 1.25 |
| Amer. Sm. & Ref. pfd. | New York | 99 | 98⅛ | 99 | Fe.20, Mh.1, | 1.75 |
| U. S. Sm. R. & M. | New York | 22⅛ | 21 | 22⅛ | Jan. '21, Q | 0.50 |
| U. S. Sm. R. & M. pfd. | New York | 40 | 40 | 40 | Ja.7, Ja.15 Q | 0.87½ |

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial, X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.